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ANNUAL REPORT

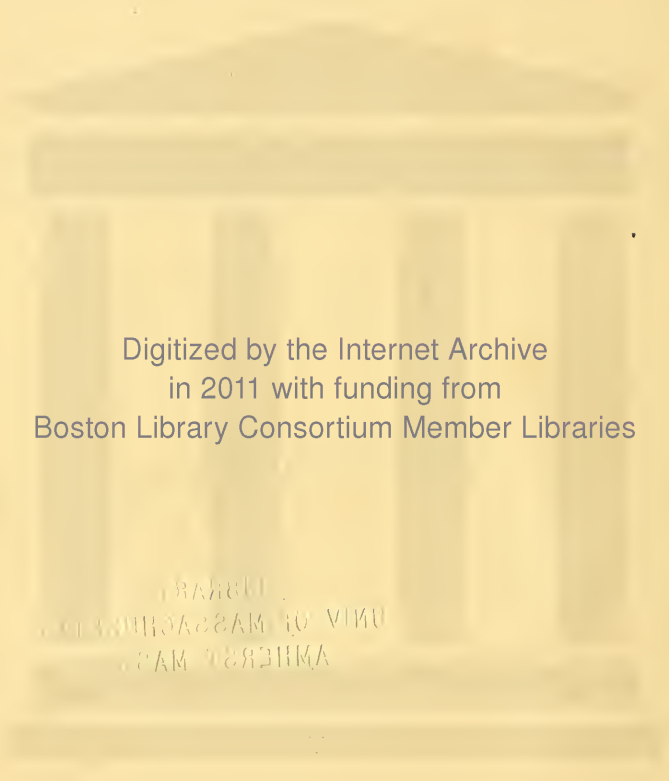
OF THE

HARBOR AND LAND COMMISSIONERS

FOR

THE YEAR 1884.

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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate and the House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submits its Annual Report for the year 1884.

BACK BAY LANDS.

The net amount received by the Commonwealth from the sale of its lands on the Back Bay, up to December 31, 1884, after deducting the cost of filling and improvement and the expenses of auction sales, is \$3,335,693.37. The sales during the year 1884 have been as follows: —

5,488 feet on Boylston Street, north side, for . . .	\$21,952 00
3,237 feet on Commonwealth Avenue, south side, for . .	16,994 25
2,688 feet on Marlborough Street, north side, for . . .	12,768 00
<u>11,413 feet in all, sold for</u>	<u>\$51,714 25</u>

More than one-third of all the land remaining for sale at the beginning of the year 1884 was disposed of during the year. The land still unsold, and for which it is estimated that the sum of not less than \$130,000 will be obtained, is located as follows: —

	FEET.
On Boylston Street, north side,	11,648
Boylston Street, south side,	7,875
Newbury Street, south side,	8,400
Marlborough Street, north side,	5,320
<u>Total unsold,</u>	<u>33,243</u>

The highest price per foot obtained in 1884 was \$5.25, the lowest price \$4.00, and the average price \$4.5311. The average price per foot of all the Back Bay lands sold to date, is \$2.1722.

A summary statement is here presented, showing the sales and other disposition of the Back Bay lands, the gross receipts and expenditures, and the net proceeds, on account of the same, from the beginning of the enterprise to the present time : —

In 1857, the Commonwealth owned on the Back Bay, .		FEET. 4,723,998
Of which there have been donated,	363,308.00	
Devoted to streets and passage-ways,	2,037,068.60	
Sold, as per last Report,	2,278,965.40	
Sold in 1884,	11,413.00	
	<hr/> 2,290,378.40	
Remaining for sale December 31, 1884,	33,243.00	
	<hr/>	<hr/> 4,723,998
The gross proceeds of land sold, as per last Report,	\$1,923,603 17	
The gross proceeds of land sold in 1884,	51,714 25	
	<hr/>	\$1,975,317 42
Rights in Parker Street sold, as per last Report,		2,300 00
		<hr/>
		\$1,977,617 42
Cost of filling, grading, etc., as per last Report,	\$1,626,008 71	
Cost of auction sales, as per last Report,	14,291 78	
Cost of curbstones, etc., in 1884,	1,623 56	
	<hr/>	1,641,924 05
		<hr/>
Net proceeds to December 31, 1884,		\$3,335,693 37

The Board was authorized, by chapter 22 of the Resolves of 1879, to sell to the Boston and Albany Railroad Company the corner land on the south side of Boylston Street and west side of Exeter Street, including the passage-way twenty-five feet wide in rear of the same, on terms and conditions to be approved by the Governor and Council. A sale of these premises, with such approval, has just been negotiated with the railroad company, at a full price per foot for the lot proper and half price for the passage-way,

with restrictions upon the occupation and use of the land which, though different from those usually inserted in the Back Bay deeds, are the same as those under which the company already holds the large adjoining tract on the south side of Boylston Street by deed from other parties.

SOUTH BOSTON FLATS.

The work of reclamation and harbor improvement at South Boston has been prosecuted steadily throughout the year 1884.

At the beginning of the year, four different sections of flats, contiguous to each other and to the flats already sold, were in process of filling under as many different contracts, all of which were fully described in the last Report. The first of these contracts, — that with Thomas Potter, — was completed during the summer, and the contractor has been paid in full.

The remaining contracts are still in process of execution. Two of them, — contracts No. 1 and No. 2 with the New England Dredging Company, — expire August 18, 1885. In order to secure the more rapid filling of a portion of the area covered by contract No. 2, and to otherwise facilitate the work, both of these contracts were modified in some of their details, and contract No. 2 was extended one year from August 18, 1884, by a supplementary agreement entered into June 20, 1884, a copy of which will be found in the Appendix to this Report.

The whole area in process of improvement by the Commonwealth, as stated in the last Report, is $99\frac{46}{100}$ acres, on which there have been deposited during the past year, under all of the contracts, 370,419 cubic yards of material, equivalent, when levelled, to $18\frac{755}{1000}$ acres completed to grade 13; and which, added to the work of previous years, make in all an equivalent of $74\frac{585}{1000}$ acres completed to grade 13.

As bearing upon the improvement of the harbor, it should also be stated that, in obtaining the material for this filling, about 84 acres of shoal places in the main channels and areas of the harbor proper, have, in the last and previous years, been dredged to the depth of 23 feet at mean low

water, thereby increasing very materially the capacity of the harbor for the accommodation of the largest class of vessels.

There was in the "Commonwealth's Flats Improvement Fund" on the first day of January, 1884, a balance of \$212,031.96 available for carrying on this work; to which there has been added during the year \$7,830.85, income of the fund, and \$5,000 received from the Boston and Albany Railroad Company in consideration of the dredging by the Commonwealth of an area in front of that company's docks at East Boston, — making \$224,862.81 available in all.

There has been paid out during the year, on account of the work at South Boston, the sum of \$154,702.15, leaving an available balance of \$70,160.66 in the fund on the first day of January, 1885. It has not, therefore, been necessary as yet to call for any part of the additional sum of \$500,000 appropriated from the fund by chapter 314 of the Acts of 1884, and the Treasurer has not, as provided in that act, been required to pay any moneys out of the general treasury into the fund. It will, however, require the sum of about \$100,000, in addition to the money now in the fund, to complete the contracts now in process of execution. Ample provision is made for this purpose in the act just referred to.

It is not necessary, and would not be wise, at the present time, and in the midst of great and general business depression, to discuss the plans to be hereafter adopted for the further development of this great enterprise and property of the Commonwealth. The contracts necessary to the execution of any such plans require the approval, and will doubtless receive the careful consideration, of the Governor and Council, as well as of this Board.

It may not, however, be amiss to call again to mind the large public spirit and confidence in the future growth and demands of the trade and business of the Commonwealth, and especially of its chief commercial city, which inspired the undertaking of the work. It was, in its first suggestion and inception, purely a scheme of harbor improvement. The Legislature of 1866, in the Resolves approving and adopting the original plan of occupation, declared that "the same, when executed, will greatly improve the harbor of

Boston, increase the commercial prosperity of the city, and benefit the Commonwealth"; and it was enjoined upon the commissioners that, in all plans and proposals submitted by them, they should always regard "the protection and improvement of the harbor of Boston as of paramount importance in any intended occupation of said flats."

The origin and importance of this enterprise are well described by Major Charles W. Raymond, U. S. Engineers, in an able and instructive paper on Boston Harbor, recently read before the Society of Arts of the Massachusetts Institute of Technology, in which he says:—

But probably the most important, and certainly the most striking, improvement [of Boston Harbor] undertaken by the authority of the Commonwealth, is the enclosing and filling of the South Boston flats. The idea of this great enterprise had its origin in a suggestion made in 1861 by the United States Commissioners, that the flats should be partly enclosed on the northeast and northwest sides by a sea wall or quay. The object of the proposed structure was to prevent the premature dispersion of the stream from the South Bay, and perhaps extend its power to the margin of the main channel. The commissioners did not, at that time, propose to reclaim any of the area enclosed. On the contrary, they recommended that it should be deepened, in order to increase its tidal influence upon the water stratum of the channel. But in 1863, after further study, the commissioners first used the term "occupation," and proposed the transfer of tide water from the South Boston flats to more interior basins. This, in brief, is the origin of this magnificent scheme of reclamation and tidal compensation.

A plan for the improvement of the flats was adopted by the Legislature in 1866, and the work was placed under the direction of the State Harbor Commission. * * * I have no doubt the enterprise is a financial success. Over four and a half million cubic yards of filling have thus far been required. The final limits of the area to be reclaimed are, I presume, as yet undetermined.

The reclamation of the South Boston flats is a work of preservation, since the enclosing walls direct the tidal currents and increase their useful effects. It is a work of improvement, since it increases the wharfrage of the water-front, and involves the removal of shoals which are inconvenient and injurious.

BOSTON HARBOR.

While the Commonwealth is devising wise and liberal measures for the preservation and improvement of this important harbor, and the United States is appropriating and expending large sums for the same purpose, — about \$1,700,000 in the last twenty years, — it needs no argument that artificial works and structures which tend to its injury ought to be carefully avoided. Oftener from a want of knowledge or appreciation of the evil effects likely to result than from wrong intent, and in the haste to secure some present end suggested by private interest or the seeming demand of municipal economy or convenience, the broader public interest is forgotten, and it becomes difficult to resist measures which are wholly indefensible in the light of well established principles of harbor conservation. The city of Boston in this way at times becomes, by the misdirected zeal of its officials, the most formidable enemy to its own harbor.

The better to enforce with high authority views which the Board has heretofore sought to impress, and not always with entire success, reference is again made to Major Raymond's paper on Boston Harbor. After speaking of the natural forces which have been at work to injure and cause the deterioration of the harbor, he says : —

Let us now turn our attention to the effects produced by the direct interposition of man. We have seen that natural causes have been at work to diminish the areas of the tidal basins, but a diminution of much greater extent has been produced by artificial constructions. The original peninsula of Boston, as it existed when its founders established the city in 1630, lies within the cross-shaded portions shown upon the map. You can see at a glance how great has been the encroachment upon the tidal reservoirs. A total land area of about two thousand acres has thus been constructed upon the water spaces, and the reservoirs have thus been diminished about one-third of their full extent.

Again, the tidal conditions have been seriously complicated by the construction of many bridges, especially over the Charles River and the Fort Point Channel, and by the formation of irregular pier lines.

Now, what are the natural effects of these great changes? In the first place, the tidal basins being reduced in area, the flowing water no longer spreads out and is quieted, so that it deposits its sediment, but it carries the material which it holds in suspension out into the upper harbor, and, when the velocity of the current is sufficiently slackened, drops it into the main ship channel. Again, the avenues connecting with the tidal reservoirs are less taxed than formerly, having to supply and drain less tide water. The currents, more especially the *outflows*, become more superficial. The consequence is that slack spaces occur along the bed and at the borders of the channel, and into these the muds quietly settle.

The evils produced by the construction of wharves and piers of irregular lengths, and by the building of bridges, are similar in kind, but probably much more serious, than those resulting from encroachments upon the tidal reservoirs. Irregular piers and wharves present to the stream a ragged front, with salient and re-entering angles. They not only check the currents, but break them into rips and eddies along their margins, with intervals of quiet water where sediment is sure to be deposited.

The piles and piers of bridges constructed without reference to the natural flow of the channel produce a variety of evils. I cannot pause to explain these injurious effects in detail. The principal one is that they destroy the unity of flow of the stream by narrowing the water-way and introducing local angular resistances. Thus local changes are produced in the current, its scouring power being increased at some points and diminished at others. The ebb and flood currents, approaching from nearly opposite directions, are differently deflected by these artificial structures, so that their paths are complicated. Thus the stream throws down its deposit in abrupt piles, instead of depositing it gradually as its velocity slackens in its progress towards the sea. In addition to this, the increased local velocities produce a scour upon the banks, thereby augmenting the quantity of material carried down by the stream and deposited in the channel.

The most striking illustration of these remarks is found in the condition of the Charles River. There are no less than fifteen drawbridges between the mouth of the river and Watertown. They are all built on piles, the aggregate number of piles being about thirty thousand. They have been constructed with every variety of inclination to the axis of the stream, and without the slightest regard to their influence upon the river's current. All the evil effects I have just pointed out are shown in an aggravated form in the Charles River.

These injurious influences were all in progress and clearly recognized by the United States Commissioners in 1866. In their final report they made the following remarks:—“The upper harbor of Boston, because of the local value of its main channel, and because of the indirect value of its tidal volume to adjacent portions of the lower harbor channels, *cannot*, in our opinion, *afford to lose another cubic yard of tide water.*”

MYSTIC RIVER.

By its act of incorporation, and by subsequent acts in amendment and extension of its grants, the Mystic River Corporation has been authorized to enclose large areas in the Mystic River by sea walls, and to fill and improve the same for docks, warehouses and wharves, upon condition of deepening by dredging, and improving for purposes of general navigation, the flats and channels of the river adjacent to the tracts so occupied. This corporation has conveyed to the Boston and Lowell Railroad Corporation a considerable portion of the territory covered by the legislative grants, with the rights and privileges attaching thereto.

By chapter 239 of the Acts of 1881, the Ocean Terminal Dock and Elevator Company was chartered, with power to buy and hold all or any part of the property and franchises of the Mystic River Corporation, and also of the Ocean Terminal Railroad Company, a corporation formed under the general railroad law. It is understood that these several corporations are organized in the interest of the same parties, and form a part of the same general scheme for utilizing the grants on the Mystic River.

Chapter 183 of the Acts of 1884 extends the time for the completion of the railroad, and for the purchase and sale authorized by the act of 1881, to May 6, 1887. It also provides that any corporation or other party acquiring by purchase or otherwise any of the lands, property or franchises of the Mystic River Corporation, shall hold the same subject to all the duties, conditions and obligations in regard to filling, excavating and improving, which are imposed on that corporation by the several acts relating thereto; and that the plans and manner of execution of all work in

or over tide waters hereafter done by it or its grantees and assigns, shall be subject to the approval of this Board.

The president of the corporation furnishes the following statement of the operations of the last year:—

Boston, January 10, 1885.

To the Board of Harbor and Land Commissioners:

GENTLEMEN,—I am in receipt of your note of the 8th instant, asking for information as to “What work has been done by the Mystic River Corporation and its grantees during the year 1884, what contracts made, etc.; also, if any lands or other property of the corporation have been acquired by grant or otherwise by the Ocean Terminal Railroad Company, or the Ocean Terminal Railroad Dock and Elevator Company, or other parties.”

I reply, that all the contracts mentioned in my report one year ago as having just previously been made by our grantee, the Boston and Lowell Railroad Corporation, are completed, the work done under them being substantially as follows:—

First. A sea wall, fifteen hundred feet in length, has been built, thus completing the quay line of sea wall bordering on the South Channel, and extending from its junction with the North Channel to the “easterly line of Elm Street extended.”

Second. A belt of pile wharf has been built, twenty-one feet in width, and extending along said new section of sea wall about thirteen hundred feet.

Third. The filling to grade from thirteen and one-half feet to fourteen and one-half feet above mean low water of an area of land of about five acres, before partially filled, and lying between said new section of sea wall and the central track of the railroad, has been done,—all the material for the filling of said area to full grade being dredged from the flats in the South Channel adjacent thereto.

Fourth. The contract for dredging above referred to involved the excavation of one hundred thousand cubic yards of flats measured *in situ*. The balance of the material so dredged, after filling the five acres above described, was deposited on the flats on the northerly side and adjacent to said central track of the railroad.

We believe that all the flats in the South Channel have now been excavated to the extent required by the several “Acts relating to the Mystic River Corporation.” The dredgings in this channel by the Mystic River Corporation, and by its grantee, the Boston and Lowell Railroad Corporation, have very materially im-

proved the navigation and usefulness of the same, as larger vessels are now constantly passing in and out through the new draw at low water, than could possibly be got through the old draw and channel at high water.

During the year, there has been a surface filling to full grade of an area of about two acres which had been previously filled to a grade of eight feet above mean low water with dredged material.

No sales, grants, or conveyances have been made to any party by the Mystic River Corporation during the year 1884.

Most respectfully,

JOSEPH E. BARTLETT,

President of the Mystic River Corporation.

BOSTON AND ROXBURY MILL CORPORATION.

By chapter 51 of the Resolves of 1884, this Board was authorized, with the approval of the Governor and Council, to make and execute an agreement with the Boston and Roxbury Mill Corporation, defining the construction of certain provisions in the indenture, and modifying certain conditions of the mortgage, entered into by said corporation with the Commonwealth June 9, 1854, in relation to the building of a sea-wall, and the filling and improvement by said corporation of certain lands between Charles River and Beacon Street on the Back Bay. An agreement has been made and executed by both parties, in accordance with the terms of the resolve, a copy of which will be found in the Appendix to this Report.

BOUNDARY LINES BETWEEN CITIES AND TOWNS BORDERING
UPON THE SEA.

Chapter 196 of the Acts of 1881 imposed upon the Board the duty of locating and defining “the courses of the boundary lines between adjacent cities and towns bordering upon the sea, and upon arms of the sea, from high-water mark outward to the line of the Commonwealth.” This work, which has occupied much of the attention of the Board from time to time since the passage of this act, and given occasion for the solution of many perplexing questions, and involved much labor in the preparation of plans and in the descriptive definition of boundaries, — is now completed; and, as required by the statute, the Board has filed a report of its doings, with suitable plans and exhibits showing the boundary lines in tide water of each and every city and town in the Commonwealth bordering on the sea, in the registry of deeds in which deeds of land situate in such city or town are required to be recorded, and also in the office of the Secretary of the Commonwealth.

The work has also involved the fixing of the boundary lines in tide water between the several counties bordering on the sea, and, subject to concurrent action, between this State and the States of New Hampshire and Rhode Island on the north and south respectively.

The territorial limits of the Commonwealth, and of the several counties, cities and towns therein, as defined by our statute laws, (Public Statutes, chapter 1, section 1, chapter 22, section 1, and chapter 196, Acts of 1881,) extend one marine league from the seashore at low-water mark; but when an inlet or arm of the sea does not exceed two marine leagues in width between its headlands, a straight line from one headland to the other is to be taken as the shore line. In fixing these territorial limits, the shore line must, therefore, be first located, either by the line of low-water mark, or as a straight line between headlands, as the case may be; and the exterior boundary line of the Commonwealth in tide water will be a line drawn parallel to and distant one marine league from such shore line.

Having fixed thus the exterior line of the Commonwealth in tide water, the boundary lines between cities and towns on the land are to be run out from high-water mark on the shore to this exterior line. The statute prescribes that they shall be so run outward to the exterior line of the Commonwealth that their course “shall conform *as nearly as may be* to the course of the boundary lines between said adjacent cities and towns on the land.” Taking this direction in its literal geometrical sense, it was found wholly impracticable, in many cases, to follow it. In some cases, towns are separated wholly by water and have no land boundary between them; or the dividing boundary is a river or channel leading to the sea, and having no regular course. In other cases, the land boundaries of a town, if extended in the same courses, would converge so as to meet before reaching the exterior line of the Commonwealth, or diverge so widely as to cut off the adjoining towns from extending outward to the exterior line. In short, the difficulties and absurdities resulting from such a construction were so many and great, as to require the taking of the statute direction in quite a different sense,—namely, that the tide-water courses should be run out so as to conform to the land courses “as nearly as may be” having due regard to the *reasonable and equitable division* of the whole tide-water area as between the several cities and towns abutting upon it.

This has been accordingly in general the controlling rule,—to so locate and define the boundary lines in tide water as to give to each city and town its fair and equitable share of the whole tide-water area adjacent to it and within the territorial limits of the Commonwealth, taking into account its frontage, its geographical position, and what seemed to be its natural rights. The only exceptions have been where the tide-water boundary is expressly fixed by statute, or had been long established by concurrent action of the towns.

Although great care has been taken, and all known sources of information have been availed of, it is quite possible that some mistakes of fact or errors of judgment have occurred. In such cases, and in all cases, the power of the legislature to correct or alter the tide-water boundaries may be invoked.

To avoid the great expense of original surveys of the shores and tide waters of the Commonwealth, the plans prepared and filed by the Board are based upon the maps and published charts of the United States Coast and Geodetic Survey. The Coast Survey Charts Nos. 8 to 13 inclusive, and the Coast Survey Harbor Charts of Boston, Salem, Provincetown, Wood's Holl, and Plymouth, Kingston and Duxbury Harbors, and tracings from the original Coast Survey Maps of the head of Buzzard's Bay and of Cohasset Harbor, have been used for this purpose.

In all, ten Plans, numbered 1 to 10 inclusive, and six Sub-Plans, numbered 1 to 6 inclusive, have been prepared, — all of which, with explanatory and descriptive reports, are filed in the office of the Secretary of the Commonwealth.

Duplicates of these Plans and Sub-Plans, arranged in groups to show the tide-water boundaries of the cities and towns bordering on the sea in each of the several Counties, are also filed, with the corresponding explanatory and descriptive reports, in the respective registries of deeds, as follows : —

Bristol County, — Plan No. 1, in the registry of deeds at New Bedford.

Barnstable County, — Plans No. 2 and No. 3, and Sub-Plans No. 1, No. 2 and No. 3, in the registry of deeds at Barnstable.

Dukes and Nantucket Counties, — Plan No. 4, and Sub-Plan No. 2, in the registries of deeds at Edgartown and Nantucket.

Plymouth County, — Plans No. 5, No. 6 and No. 7, and Sub-Plans No. 1, No. 4 and No. 5, in the registry of deeds at Plymouth.

Norfolk County, — Plan No. 7, and Sub-Plan No. 5, in the registry of deeds at Dedham.

Suffolk County, — Plans No. 8 and No. 9, in the registry of deeds at Boston.

Essex County, — Plans No. 9 and No. 10, and Sub-Plan No. 6, in the registry of deeds at Salem.

Copies of all the foregoing plans, sub-plans and reports are also on file in the office of this Board.

FIELD AND OFFICE WORK.

Miscellaneous Surveys.

The surveys and other work in connection with the several contracts for filling the South Boston Flats, have constituted the largest part of the field work during the year. In addition to this work, special surveys have been made as follows:—

In January, a survey of that portion of Fort Point Channel, between Congress Street and Federal Street Bridges, which was dredged under a contract with the New England Dredging Company, dated December 5, 1883.

In May, a survey of that portion of Charles River Basin just above West Boston Bridge, from which the material was dredged for filling the flats of the Boston and Roxbury Mill Corporation, west of West Chester Park.

In May, also a survey of the wharf extensions in Harbor Cove, Gloucester Harbor, which had been made since the survey of February, 1883.

In May and June, the resurvey of the wharf lines of Boston Inner Harbor was continued along the northerly shore of South Boston, plotting it on the same scale as the earlier portion of this survey, viz., $\frac{1}{1000}$.

In June, a survey of the area off Pier No. 6, Grand Junction Wharves, East Boston, which had been dredged by the Commonwealth in accordance with an agreement with the Boston and Albany Railroad Company.

In June, also a survey of the area at South Boston which would be covered by an extension of Mount Washington Avenue to B Street, to determine its present condition, and what rights the Commonwealth may have in it.

In August, borings were made on the site of a proposed pier east of the "fifty-acre lot," South Boston Flats, to determine the character of the foundation required for the sea wall; and plans and specifications have been prepared in accordance with the data thus obtained.

In August and September, a survey of Mystic Wharf and River, from the point where the Boston and Lowell Railroad

enters the wharf to the centre of the channel between Charlestown and East Boston, and from the Charlestown shore to the Chelsea shore.

The office work in connection with these surveys has also occupied much time.

Licenses Granted and Plans Approved for the Erection of Structures in and over Tide Waters.

About the average number of applications has been made to the Board, during the last year, for licenses for wharves and other structures in and over tide waters, and for the approval of plans for structures authorized by the legislature. A list of the licenses granted and plans approved, fifty-seven in all, is hereto appended :

Nos.

791. Petition of A. B. Carey for license to construct a pile wharf at Vineyard Haven in the town of Tisbury. Granted January 3, 1884.
792. Petition of the Fitchburg Railroad Company for license to construct a pile platform in Miller's River in the cities of Boston and Somerville. Granted January 10, 1884.
793. Petition of Dexter J. Cutter for license to construct two buildings on piles in and over Mill Creek in the Dorchester District of the city of Boston. Granted February 7, 1884.
794. Petition of Samuel G. Pool, William Parsons and D. I. Robinson for license to extend their wharf in Gloucester Harbor. Granted February 21, 1884.
795. Petition of Parmenter, Rice and Company for license to construct an extension to their wharf in Gloucester Harbor. Granted February 21, 1884.
796. Petition of the Foster's Wharf Company for license to construct an extension to its wharf on Fort Point Channel in the City of Boston. Granted April 10, 1884.
797. Petition of Maria Johnson for license to construct an extension to the "Lakin Wharf," so called, on Town River in the town of Quincy. Granted April 17, 1884.

Nos.

798. Petition of George H. Tyler for license to construct a wharf, partly solid and partly on piles, in Boston Harbor in the town of Winthrop. Granted April 17, 1884.
799. Petition of John G. Bennett for license to construct a pile extension to his wharf in Gloucester Harbor. Granted April 17, 1884.
800. Petition of George R. Bradford for license to construct a solid wharf at Fort Point in Gloucester Harbor. Granted May 1, 1884.
801. Petition of Michael Cashman for license to construct a wharf, partly solid and partly on piles, in Lynn Harbor. Granted May 1, 1884.
802. Petition of the Marblehead Gas Light Company for license to construct an extension to its wharf in Marblehead "Little Harbor." Granted May 1, 1884.
803. Petition of Horace Cousens for license to construct an extension to his wharf on Charles River in the City of Boston. Granted May 1, 1884.
804. Petition of Charles A. Pardee and John M. Young for license to construct a pile wharf at Mount Hope Bay in the City of Fall River. Granted May 8, 1884.
805. Petition of the town of Manchester for the approval of plans for the construction of a bridge or culvert over Black River in the town of Manchester, as authorized by chapter 142 of the Acts of 1884. Approved May 12, 1884.
806. Petition of the Naumkeag Steam Cotton Company for license to construct a wharf by solid filling in South River, Salem Harbor. Granted May 15, 1884.
807. Petition of Edward P. Shaw for license to construct a pile wharf on Merrimack River in the town of Salisbury. Granted May 22, 1884.
808. Petition of William S. Merryman, Orlando Brown and Greenleaf Clark, Jr. for license to construct a one-story building over Little River in the City of Haverhill. Granted May 22, 1884.

Nos.

809. Petition of Theodore Brown for license to extend his wharf in Wellfleet Harbor. Granted June 5, 1884.
810. Petition of the Clark's Cove Guano Company for license to construct a sea wall and pile wharf at Clark's Cove in the town of Dartmouth. Granted June 12, 1884.
811. Petition of Jesse R. Atwood for license to extend his wharf to the channel dredged by the United States in Plymouth Harbor. Granted June 12, 1884.
812. Petition of William H. Nelson and Jesse Harlow for license to extend their wharf to the channel dredged by the United States in Plymouth Harbor. Granted June 19, 1884.
813. Petition of the Point of Pines Company for license to construct a pile structure on Point of Pines in the town of Revere. Granted July 10, 1884.
814. Petition of Otis Shepard for license to dredge a channel and to do certain filling in Harrison Square Bay in the City of Boston. Granted July 10, 1884.
815. Petition of N. E. Harlow for license to extend and connect his two wharves in Plymouth Harbor. Granted July 10, 1884.
816. Petition of the City of Cambridge for license to construct an extension to the hauling pier of Western Avenue Bridge in the Charles River. Granted July 10, 1884.
817. Petition of the City of Boston for license to widen the Meridian Street Bridge over Chelsea Creek in said City of Boston. Granted July 10, 1884.
818. Petition of Martin Brimmer for license to construct an addition to the T Wharf adjoining Atlantic Avenue in the City of Boston. Granted July 24, 1884.
819. Petition of John S. Martin for license to extend his wharf, formerly known as Potter's Wharf, in Marblehead Harbor. Granted July 24, 1884.
820. Petition of R. G. Tarrant for license to build a pile wharf in Provincetown Harbor. Granted July 24, 1884.

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Nos.

821. Petition of the Standard Sugar Refinery for license to construct an extension to its wharf on Fort Point Channel in the City of Boston. Granted July 31, 1884.
- 822, 822^a. Petition of Francis B. Hayes for license to construct a solid wharf on Fort Point Channel in the City of Boston. Granted July 31, 1884.
823. Petition of Benjamin F. Allen and Daniel Allen, Jr. for license to construct a wharf at Five Pound Island in Gloucester Harbor. Granted August 7, 1884.
824. Petition of Benjamin F. Allen and Daniel Allen, Jr. for license to extend their wharf at the west end of Five Pound Island in Gloucester Harbor. Granted August 7, 1884.
825. Petition of the Walker and Pratt Manufacturing Company for license to convert its present pile wharf into a solid wharf, and also to extend the same, on the Charles River in the town of Watertown. Granted August 7, 1884.
- 826, 826^a. Petition of the Board of Directors of the East Boston Ferries for license to construct four piers for ferry slips at the foot of Eastern Avenue in the City of Boston. Granted August 7, 1884.
827. Petition of Elizabeth H. Foster for license to construct a wharf on piles in Gloucester Harbor. Granted August 14, 1884.
- 828, 828^a. Petition of the Boston Dye Wood and Chemical Works for license to construct a sea wall to retain solid filling in Boston Harbor at East Boston. Granted August 14, 1884.
829. Petition of John P. Woodbury for license to construct a wharf in Lynn Harbor. Granted August 13, 1884.
830. Petition of the Sandy Bay Pier Company for license to construct a solid wharf at Long Cove in the town of Rockport. Granted August 21, 1884.

Nos.

831. Petition of the United States, by Spencer F. Baird, U. S. Commissioner of Fish and Fisheries, for license to construct a wooden bulkhead in Wood's Holl Harbor. Granted August 28, 1884.
832. Petition of the Eastern Railroad Company for license to construct a new draw in its bridge at Beverly. Granted August 28, 1884.
833. Petition of the City of Boston for license to widen its part of Cambridge Street Bridge over the Charles River in the Brighton District. Granted September 4, 1884.
834. Petition of John C. Weeks for license to construct a pile pier in Provincetown Harbor. Granted September 18, 1884.
835. Petition of the City of Boston for license to rebuild its part of North Beacon Street Bridge over the Charles River in the Brighton District. Granted September 18, 1884.
836. Petition of Ann Nickerson for license to extend her wharf on piles in Provincetown Harbor. Granted September 18, 1884.
837. Petition of the Standard Sugar Refinery for license to extend its wharf, partly solid and partly on piles, on Fort Point Channel in the City of Boston. Granted September 18, 1884.
838. Petition of the Shawmut Boat Club for license to construct a boat house on piles on Fort Point Channel in the City of Boston. Granted September 25, 1884.
839. Petition of Lemuel Marquand for license to extend his wharf on Merrimack River in the town of Salisbury. Granted October 9, 1884.
840. Petition of the Mount Hope Iron Company for license to extend its wharf on Taunton River in the town of Somerset. Granted October 23, 1884.
841. Petition of Azariah F. Crowell and Isaiah Spindle for license to extend the "Bar Neck Wharf" in the Harbor of Wood's Holl. Granted October 23, 1884.

Nos.

842. Petition of William Minot, Jr., for license to construct a wharf on Buzzard's Bay in the town of Wareham. Granted November 6, 1884.
843. Petition of Ignatius Sargent for license to construct a pile wharf in Waquoit Bay in the town of Falmouth. Granted November 6, 1884.
844. Petition of the Roxbury Gas Light Company for license to construct a sea wall or bulkhead in Roxbury Canal in the City of Boston. Granted November 13, 1884.
845. Petition of George H. Harwood and George H. Quincy for license to construct a pile structure in and over the Charles River in the town of Watertown. Granted December 11, 1884.
846. Petition of the City of Boston for the approval of plans for the location of the new piles for the structure in the waters of the Charles River authorized by chapter 327 of the acts of 1884. Approved December 18, 1884.
847. Petition of the City of Boston for the approval of plans for the construction of a sea wall and for certain filling for a public park on the Charles River between Cragie's and West Boston Bridges in said city, as authorized by chapter 92 of the acts of 1881. Approved December 12, 1884.

RECEIPTS FROM GRANTS OF TIDE-WATER LANDS.

The amount charged during the past year for grants of rights and privileges in tide-water lands of the Commonwealth, under licenses of this Board for filling and for the erection of wharves and other structures in and over tide waters, is \$3,682.50, of which \$2,532.50 has been already paid into the State treasury. The total amount so charged and paid into the treasury, since the passage of the act of 1874 requiring such payments, is \$154,741.77. All receipts from this source are, by chapter 8 of the Resolves of 1872, pledged and paid into the Troy and Greenfield Railroad sinking fund.

HARBOR IMPROVEMENTS BY THE UNITED STATES.

The works of the national government for the preservation and improvement of the harbors and rivers on the coast of Massachusetts, have remained under the supervision of the same able and efficient officers of the United States Corps of Engineers who had charge of them at the date of the last Report, — those on the Eastern section of the coast in charge of Maj. Charles W. Raymond, who is stationed at Boston, and those on the Southern section in charge of Lieut. Col. George H. Elliot, whose headquarters are at Newport.

To both of these gentlemen, as to their predecessors, this Board has been steadily indebted for courteous and valuable coöperation and assistance, and their advice as skilled engineers and experts, — especially that of Maj. Raymond, owing to the greater convenience of access to his office in Boston, — has been often sought and cheerfully given.

Improvements on the Eastern Coast of Massachusetts.

Major Raymond has kindly furnished a summary report of the work done under his official supervision during the year 1884, which is too concise for further condensation, and is here presented in full : —

UNITED STATES ENGINEER OFFICE,
BOSTON, MASS., January 15, 1885.

The Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN : — In compliance with your request of December 30, 1884, I take pleasure in sending you the following abstract of work done, under my charge, by the United States in the harbors and rivers of Massachusetts, during the past year.

1. Newburyport Harbor.

The submerged core of the north jetty, the top of which is in the plane of mean low water, has been extended for a distance of 385 feet. The total length of the jetty is now 2,425 feet, 1,540 feet having been completed to the full height. During the year, 8,000 tons of stone have been placed in position.

The submerged core of the south jetty has been partly constructed for a distance of 200 feet, 400 tons of stone having been placed in position. The total length of the jetty is now 1,277 feet, 1,077 feet having been completed to the full height.

A catch-sand has been built in rear of the shore extension of the south jetty, to check the action of the wind in lowering the surface. It is necessary to preserve the elevation in this locality, to guard against the possible opening of a new channel in rear of the jetty. The catch-sand consists of open frames of timber and wire filled with sea-weed. The aggregate length of the main work and its spurs is 606 feet.

The dike across the mouth of Plum Island Basin has been strengthened.

Frequent surveys of the bar and entrance to the river, and of the shore lines, have been made for the purpose of watching the changes now in progress.

So far as the results can be interpreted at this early stage of the work, they are satisfactory, and promise its ultimate success.

2. *Merrimac River.*

The channel at Rock's Bridge was widened and deepened so that vessels drawing 12 feet can pass through the new draw at high water, about 1,057 cubic yards of material being removed by dredging.

3. *Sandy Bay, Rockport.*

The project for a breakwater to form a harbor of refuge, has been the subject of further study. In this connection, a project for the improvement of the harbor of Gloucester, and another for the construction of a harbor at Thatcher's Island, Cape Ann, have been prepared and investigated. Elaborate wreck statistics for the New England coast have been collected and tabulated, and a wreck-chart has been constructed.

4. *Lynn Harbor.*

The lower channel extending from near White Rocks to deep water opposite Nahant, a distance of about 3,600 feet, was enlarged by dredging, so that it is now 200 feet wide and 10 feet deep at mean low water. The upper channel, from deep water opposite Sand Point to the Lynn harbor line, was dredged to a width of 100 feet and a depth of 10 feet at mean low water. A total of 170,445 cubic yards was removed from these channels.

5. *Boston Harbor.*

The rubble stone aprons for the protection of the shores of Lovell's Island were completed, about 9,696 tons of granite grout and chips being placed in position.

The sea wall protecting the north head of Deer Island was repaired.

The sea wall at George's Island was repaired and strengthened, and the rip-rap shore protection at its west and south ends was increased by the addition of 1,307 tons of granite grout.

The sea wall at Rainsford Island was rebuilt for a distance of 182 feet, and partly rebuilt for a distance of 33 feet. At its foot, 1,310 tons of granite grout were placed in apron. In rear of the coping course, 530 square yards of paving were relaid, and the paving was extended over an additional area of 452 square yards.

The rock discovered in 1883 near the edge of the channel at Castle Island shoal was removed.

Preparations were made for the execution of a detailed hydrographic survey of the Lower Harbor, as the basis of a project for its preservation and improvement. This work will be done during the coming season.

6. *Charles River.*

The channel was enlarged by dredging from a point opposite Stickney's wharf in Cambridge to the Arsenal Street bridge, a distance of 7,300 feet. Its least width is now 80 feet, and 100 feet in turns, and its least depth 6 feet at mean low water, or about 16 feet at mean high water. During the year, 23,194½ cubic yards of material were removed.

7. *Hingham Harbor.*

About 3 cubic yards of rock were removed from several points in the channel, in order to secure a uniform depth of 8 feet at mean low water.

8. *Scituate Harbor.*

The bar at the entrance of the harbor was dredged, 11,329 cubic yards of material being removed. This work will be continued during the coming season under the existing contract.

9. *Plymouth Harbor.*

The channel leading to the wharves was widened and deepened by dredging, 47,257 cubic yards of material being removed. It now has a least width of 90 feet, and a least depth of 9 feet at mean low water.

10. *Provincetown Harbor.*

The Abel Hill dike was repaired and strengthened, and a ramp was constructed over its southern end.

The breakwater at Long Point was backed with trees and about 200 tons of stone.

Preparations were made for the execution of a detailed hydrographic survey of the harbor and its approaches, as a basis for the investigation of changes now in progress. This work will be done during the coming season.

11. Examinations and Surveys.

By authority of the River and Harbor Act of July 5, 1884, preliminary examinations were made in Gloucester, Salem, Marblehead, Boston, Hingham and Plymouth Harbors, and in the Powow River, and preliminary reports based thereon were submitted to the Engineer Department.

Surveys with a view to improvement were made in Gloucester, Boston and Hingham Harbors, and a survey of the Powow River is now in progress. Projects for improvement in these localities are in course of preparation.

For further and more detailed information concerning the character, condition and progress of the works of improvement under my charge, I beg to refer to my annual report for the fiscal year ending June 30, 1884, which will be transmitted to you as soon as it is printed. I desire especially to invite your attention to the proposed widening of the main ship channel in Boston Harbor at the Upper and Lower Middle, which is fully considered in my report. This is a work of great importance, and it is very desirable that it should be executed in connection with the improvements now in progress under your direction.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,

Major of Engineers.

The proposed widening of the main ship channel at the Upper and Lower Middle, to which Maj. Raymond refers above, is unquestionably a work of prime and urgent necessity to the improvement of Boston Harbor. The estimated cost is \$128,000, and it is deeply to be regretted that, in the River and Harbor bill just reported to Congress, the sum of \$50,000 only is proposed to be appropriated for this purpose. This sum is not only inadequate to the doing of the whole work absolutely required, but to the doing of any part of it with economy.

Another reason in favor of a sum large enough to allow the contracting of the whole work the present season, is, as suggested by Maj. Raymond, that the Commonwealth now

has a contract in process of execution in connection with the filling of the South Boston Flats,—itself a great work of harbor improvement,—under which the material dredged by the government contractor could be dumped at a receiving station in near proximity to the channel proposed to be widened, and utilized in the filling of these flats. Unless this opportunity is availed of, the dredged material must be carried a long distance to be dumped at Hangman's Island or some other point in the lower harbor. In the latter case, the material would not only be wasted, but its removal would involve a larger cost per cubic yard to the government.

Improvements on the Southern Coast of Massachusetts.

The Board is indebted to the courtesy of Lieut. Col. Elliot for a copy of his official report of river and harbor work done under his charge during the year ending June 30, 1884, from which the following extracts are made:—

Hyannis Harbor.

This harbor, on the northern shore of Nantucket Sound, is sheltered by a breakwater 1,170 feet long, constructed by means of several small appropriations which were made from time to time in the years 1827–1838, amounting to \$70,904.82. * * * It is now in fair condition, and affords effective shelter for the anchorage of about 175 acres, but the depth of water inside is insufficient, and complaint is made that vessels drawing more than 15 feet have to remain outside the breakwater in an exposed position. The anchorage undoubtedly needs deepening to meet the requirements of the great amount of commerce which passes through Nantucket Sound.

The facilities for entering the harbor are soon to be increased by the erection of a small light on the shore, to range with Hyannis Light and guide through the entrance; if practicable, a bell-buoy should mark the eastern end of the breakwater in thick and foggy weather.

This is the only harbor of refuge between Cape Monomoy and Wood's Holl, a distance of 33 miles. A branch of the Old Colony Railroad terminates here, and considerable quantities of coal and lumber are landed at Hyannis.

Nantucket Harbor.

Nantucket Harbor * * * has deep water inside, and would form an excellent harbor of refuge for vessels plying between the South and all Atlantic ports north of Cape Cod, were it not for the shoal bar which obstructs its entrance. * * * In 1829 a project for dredging a channel through the bar was adopted, and in the years 1829 to 1832, inclusive, the sum of \$40,924.12 was expended in carrying it out. No permanent improvement resulted from this expenditure.

The present approved and adopted project consists in extending jetties of riprap stone from the eastern and western sides of the entrance across the bar to deep water outside, for the purpose of concentrating the strength of the tidal currents and the excavation of a deep channel by natural forces. The western jetty was to be built first and the other as developments should show its necessity.

The amount expended on this project up to the close of the fiscal year ending June 30, 1883, including liabilities outstanding at that date, was \$65,769, and the result was the construction of the western jetty to a point 3,075 feet from its initial point on shore. At the beginning of the last fiscal year, the extension of the western jetty was in progress, * * * and it continued until August, 1883, when the contract was completed. * * *

Work under the new contract was commenced on the 6th of August, 1883, and it was continued during the fall and winter until the 2d of February, 1884, when, by reason of the continued severity of the weather, it was determined to postpone operations until the spring. On the 29th of April, 1884, they were resumed, and at the close of the year the work was still in progress. * * *

The usual comparative hydrographic surveys were continued as time could be spared from other work, and an extensive series of borings was made to determine the character of the bottom to 15 feet below mean low water along the proposed route of entrance between the jetties, and also on lines covering any probable position of the eastern jetty. In all cases the material was found to be sea sand, often mixed with gravel in varying proportions.

The amount expended during the year, including liabilities outstanding June 30, 1884, was \$22,412.11. The western jetty was extended 440 feet, making a total distance of 3,515 feet from the initial point on the shore. The distance at the close of the year of the end of the jetty from the 12-foot curve on the outer side of the bar, was about 2,371 feet.

With the available remainder of the appropriation of August 2, 1882, it is proposed to complete the current contract for extending

the western jetty. * * * It will probably carry the outer end to a point about 4,016 feet from the shore end, or to about 1,870 feet from the 12-foot curve on the outer slope of the bar. * * *

It has been intended to devote the next appropriation to the commencement of the construction of the eastern jetty, since it has been found that the scouring of a deep channel through the bar will require more concentration of the strength of the tidal current than can be effected by a single jetty; but the inner part of the eastern jetty * * * should not be undertaken before sufficient means are provided for finishing it in one working season, for otherwise its construction might prove temporarily inconvenient to the local commerce of the port.

It is proposed to hold the amount appropriated by the act of Congress of July 5, 1884 (\$10,000), until the whole amount of the estimated cost of this portion of the eastern jetty (not less than \$85,000) can be made available. It is earnestly hoped, therefore, that not less than \$75,000 will be appropriated at the next session of Congress, so that by commencing early in the summer of 1885 this part of the work can be completed before the winter of that year. * * * The amount thus far appropriated for the work is \$110,000.

Wood's Holl Harbor.

The name "Wood's Holl" is applied to a strait connecting the waters of Buzzard's Bay and Vineyard Sound, and also to a harbor situated on the strait. This harbor is divided into Great Harbor and Little Harbor. The mean rise and fall of the tide is about 2 feet. * * *

In 1853 and 1854, \$2,482.76 was expended in the construction of a breakwater on the northern side of Great Harbor, to close a passage through which water passed in storms between it and Buzzard's Bay. The amount was insufficient for the work, and the remainder of the cost was borne by private parties.

In the years 1879-1881, there was expended \$14,094.26 in cutting a channel through the bar into Little Harbor 130 feet wide and 10 feet deep at mean low water, and in widening and deepening the strait into Buzzard's Bay. At no place in the main channel of the strait was it left less than 120 feet in width at 9 feet depth at mean low water, or 140 feet in width at $7\frac{1}{2}$ feet depth at the same stage of tide.

The present approved and adopted project consists in the construction of retaining-walls and a hollow pier for the use of the United States Fish Commission, and to serve also as a coaling station for the Revenue Marine and other branches of the public

service, and as a harbor of refuge. The amount expended on the project * * * at the close of the fiscal year ending June 30, 1883, including preliminary surveys and liabilities outstanding at that date, was \$2,914.64, and the result was the removal of 269.84 cubic yards of bowlders from the site of the pier and retaining-walls, in depths of water from 3 feet to 20 feet at mean low water. * * *

The amount expended during the last fiscal year, including liabilities outstanding on the 30th of June, 1884, was \$33,903.18. The eastern, southern, and western retaining-walls, and the excavation of the trenches for the foundations of all the pier-walls, were completed. The riprap foundation of the east pier-wall was wholly, and that of the south pier-wall was nearly, completed. About one-fourth of the masonry of the east pier-wall was completed, and the masonry of the south pier-wall was commenced.

With the remainder of the funds available from the former appropriations, and the appropriation made by act of Congress of July 5, 1884, it is proposed to complete the pier-walls, to dredge inside the pier, to provide the wharfing required by public vessels, and to fill in behind the retaining-walls as far as the funds will permit.

The estimate of the cost of improvements originally contemplated and of additional work was \$77,775, and there has been appropriated \$77,000. * * * There remains to be provided by an additional appropriation the sum of \$8,669.

Wareham Harbor.

This harbor is an estuary at the head of Buzzard's Bay. * * * Before improvement, the ruling depth in the harbor was about 7 feet at mean low water in a narrow and very crooked channel. Long Beach, a narrow sand-spit at the mouth of the harbor, was washed and abraded by the waves and currents at high water, and the material was carried into and shoaled the channel inside. The mean rise and fall of the tide is 4 feet.

The original approved and adopted project of 1871 for the improvement, and its subsequent modification, was to straighten the channel, and widen it to 100 feet in the upper and 300 feet in the lower part. The depth in the upper part was to be 9 feet and in the lower part 10 feet at mean low water. * * * The present enlarged plan, the one under which we are now working, provided for making a channel 250 feet wide and 10 feet deep at mean low water from Barney's Point down to the entrance to the harbor. Above Barney's Point the width of the channel was to be 350 feet, with the same depth — 10 feet — as below that point. The plan

included also the raising and strengthening of Long Beach to carry it above the storm waves and currents and to hold it there, in order to prevent the filling of the improved channel above by material abraded from the beach.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1883, including liabilities outstanding at that date, was \$13,008.74, and the result was a channel through and above the upper bar to the wharves, with a width not less than 100 feet and a depth of 10 feet at mean low water. No work was done in the lower part of the harbor under this project.

Long Beach, of which a large portion was originally submerged at low water, was raised above high-water storm-tides, except in a few places, so that the major part of the wash of sand into the improved channel inside the beach had been stopped.

By reason of the small amount available for this harbor, operations [during the last fiscal year] have been confined wholly to the works of protection at Long Beach. [A detailed description of the stone and brush walls, jetties, windrows of brush, etc., which have been constructed for this purpose, is here omitted.] The results of these works are very satisfactory. * * *

With the available remainder of the appropriation of August 2, 1882, and the appropriation made by the act of Congress of July 5, 1884, it is proposed to carry on the work of improvement according to the present approved and adopted project, and as far as the funds will permit. The estimated cost of this project was \$44,050. Of this amount there has been appropriated \$25,000.

Taunton River.

This river * * * is about 44 miles in length, measured along its course. Taunton, at the head of navigation, requires large quantities of coal, iron, clay, moldings, sand, and other heavy articles for its extensive manufactures, which depend on water transportation for successful competition. * * *

The original and adopted project of 1871, and its subsequent modifications, provided for a channel not less than 60 feet wide and 11 feet deep at mean high water above Berkley Bridge Shoal, and not less than 80 feet wide and 12 feet deep at mean high water through and below that shoal, with additional width at the bends. The ledge which crosses the bottom of the river at Peters' Point, and the numerous bowlders which lay on the bottom and sides of the channel from Weir to Dighton, were to be removed.

The amount expended on the improvement of the river up to the close of the fiscal year ending June 30, 1883, including liabilities outstanding at that date, was \$109,561.65, and the result was a

continuous channel not less, at any place, than 11 feet deep at mean high water from the bridge at Weir to and partly through Briggs' Shoal. The improvement below Briggs' Shoal had increased the navigable depth to about 10 feet. * * *

The amount expended during the last fiscal year, including liabilities outstanding on the 30th of June, 1884, was \$19,071.14. The excavation of the 11-foot channel was continued through Briggs' Shoal, and from Briggs' Shoal to Berkley Bridge Shoal. The 12-foot channel was carried through Berkley Bridge Shoal and down to Wikamount. Some hard material in the channel in the upper part of The Nook and at Wikamount, which was not covered by the Fenner contract, was left for a future appropriation. The bottom and sides of the channel were cleared of bowlders from Weir down to Berkley Bridge. This work was thoroughly done, and it is believed that no bowlders remain in this part of the channel, although some may have escaped detection.

With the available remainder of the appropriation of August 2, 1882, and the appropriation made by the act of Congress of July 5, 1884, it is proposed to carry on the work of the improvement according to the approved and adopted project, for the completion of which it is hoped the funds will be sufficient.

The completed improvement will enable three and four masted schooners, carrying from 600 to 1,400 tons, and barges of equal capacity, to reach Taunton. The estimated cost of this project was \$94,000, the entire amount of which has been appropriated.

CONSERVATION OF THE CONNECTICUT RIVER.

This Board was authorized and directed, by chapter 58 of the Resolves of 1884, “to examine the channel and course of the Connecticut River within the confines of this Commonwealth, and to investigate the cause and effects of floods upon the same, and to report to the next General Court the necessity or expediency of any legislation for the preservation and improvement of said river, and for the promotion of all interests connected therewith.”

The Connecticut River, so far as it lies with the limits of this Commonwealth, though of sufficient size and volume to be useful in some degree for the passage of boats and for other transportation, is not a *navigable* river in the common-law sense of the term, because above the point where the tide ceases to ebb and flow. Not being in this sense a navigable or tide-water river, the right and title of the riparian owners on either side of the river extend to the thread of the river or middle of the stream; but subject to a right or easement in the public to use its waters for boating, rafting, and the like purposes, and subject also to the right of the legislature to regulate and control its fisheries.

This river does not, therefore, come within the scope of the regular duties of a commission whose supervision extends to tide waters only; but the Board has willingly undertaken the novel duty imposed by the resolve, and has been much interested in the investigations to which it has given rise.

With a view to ascertaining most readily and fully the facts and views out of which the resolve had grown, two public hearings have been had, — the first at the court-house in Northampton, and a second at the office of the Board in Boston. Notice of the first hearing was given by advertisement in the local newspapers, and by circulars mailed to the officials of all the cities and towns abutting on the river, and to such other persons and parties as were believed to be especially interested or informed in regard to the subject matter of the resolve. Several of these cities and towns, the county of Hampshire, and the business interests chiefly concerned in the use of the river, were represented at the

hearing. Citizens of Northampton and other places were present in the public interest, and aided materially the investigations of the Board. Several members of the last and of the present legislature, and several experts in engineering, were also in attendance by invitation. Many of the same parties, with others, were present at the later hearing in Boston.

The Board has also visited some of the localities where the action of the river is complained of as especially injurious, or where its attention was asked to structures built in the river for business uses, or where the protection of the banks has been secured or attempted by artificial means.

It may be stated at the outset, as the result of the hearings, that no present scheme or proposition is advanced for the undertaking of any system of works for the improvement or preservation of the river. There is, on the contrary, a general and, as it seems, an intelligent conviction that it would be unwise and premature to attempt to decide upon the feasibility or the methods of any system of artificial treatment of the river, without further investigation and light.

The principal facts and suggestions submitted, either verbally or in writing, may be stated in substance as follows :—

1. That the channels; banks and course of the river are continually changing, in some places rapidly, and to the serious detriment of public as well as private interests. No accurate record of these changes exists, and the observation or memory of individuals in regard to them is conflicting and unreliable.

2. That artificial structures have been built from time to time in or across the river for business uses, and may be required in the future, especially by the lumbering interest; and that, while there is no feeling of hostility towards this or any other interest using the river, but, on the contrary, a disposition to allow every necessary and reasonable facility in its use, there is some apprehension in regard to the actual or probable effect of some of these structures upon other interests, public or private, and a feeling that the location, mode of construction and maintenance of all artificial struc-

ures within the bed and banks of the river, should be subject to some system of public regulation and control analogous to that which supervises the building of railroads or the erection of structures in tide waters.

3. That there has never been any uniform plan or system governing the construction of the various improvements, defensive works, dikes or levees, breakwaters, booms, piers, etc., in or adjacent to the river, with reference to their influence upon the flow of the river and its action upon its bed and banks; that the attempts to restrain the ravages of the river by protecting works have, with few exceptions, been disjointed, ill-advised and unsuccessful; and that an approved general system, based upon principles and rules which are the result of scientific investigation and study, is needed to guide the construction and prevent the injurious effects of all such structures and works, and to secure the concerted and successful action of all the different interests for their common benefit and protection.

4. That the floods to which the river is subject expose a large territory and large interests to serious damage; that many observers believe that the currents of the river, by reason of the increase of artificial obstructions, or from other causes, do not remove deposits as rapidly as formerly, and that the channels are "silting up," the bed becoming higher and more shallow, and the dangers from floods in consequence aggravated; that long and severe droughts are also a source of much inconvenience and loss; and that the subject of the control of floods and droughts by storage basins or otherwise is now receiving much attention in this and other countries, and is deserving of careful consideration and study in connection with this river.

5. That, within a comparatively recent period, large manufacturing interests have grown up at different points upon the river; that the dams of the water-power companies, and the booms and piers of the lumber companies, and the storage of logs, have altered the natural flow and habit of the river, and are tending to change its whole régime; and that these changes and their effects should be carefully observed and noted, so that injurious results may be seasonably averted.

6. That sufficient data do not now exist for prescribing the best methods for the preservation and improvement of the river, and for "the promotion of all interests connected therewith;" that, as the first step towards determining a proper system of treatment, whether in general or in detail, a survey and plan of all that portion of the river within the Commonwealth should be made, accurate levels established at points along its banks, sufficient soundings taken to determine the location and depth of its channels, and such other physical facts and features noted as would enable competent experts to study and prescribe the best general system of treatment, and to solve such practical questions as might from time to time arise; and that daily observations of the heights of the water at selected points should also be taken and recorded.

7. That such survey and plan would furnish a reliable basis for determining, by comparison with future surveys, the changes which had taken place in the channels, banks and course of the river, the remedies to be applied, and the rights of all parties affected thereby; that the results of all such surveys and observations should be made public official records, and as such should be received as evidence of the facts therein contained; and that such records would be of great value, not only as regards rights and interests between parties in this State, but for the protection of important interests in this State against encroachment by parties in other States, as in the case of the raising of the dam at Enfield Falls in Connecticut.

8. That such legislation should be sought as may be necessary to enable the carrying out, under the sanction and authority of the Commonwealth, of the substance and spirit of the measures above proposed.

It will be observed that some of the above suggestions are argumentative in their character, and, as such, carry their own weight, and seem to need no further comment in this Report.

As bearing upon many of the facts alleged or involved in the above statements, and as throwing much light upon the whole subject under investigation, the Board is enabled to

present, as a part of its Report, the following interesting and instructive paper by CLEMENS HERSCHEL, an engineer of established reputation and authority, who has attended upon the hearings and drawn up this paper at the request of the Board. Mr. Herschel's position as the hydraulic engineer of the Holyoke Water Power Company, has given him special occasion and opportunity to study and observe the physical history and characteristics of the river, and his statements of fact and opinion are entitled to corresponding weight.

To the Board of Harbor and Land Commissioners:—

Agreeable to your request, I have the honor to submit the following paper upon the physical and some utilitarian features of the CONNECTICUT RIVER, — of that portion of it, more especially, which lies within this Commonwealth:

The Connecticut River crosses the State of Massachusetts on a length of about forty-nine miles, measured in a straight line, and running nearly due north and south; roughly measured along its channel, there are about fifty-nine miles of the river within the limits of the State.

An itinerary of the river, beginning where it leaves the territory of Massachusetts flowing towards the south, and proceeding northerly, would be somewhat as follows:

Distance from Southern State Line.	Above Mean Level of the Sea.	Locality.
0 miles.	40.25 feet.	Southern State Line.
5 "	40.50 "	City of Springfield.
12 "	40.75 "	Willimansett Bridge.
14 "	98.00 "	Holyoke Dam.
18 "	98.40 "	Smith's Ferry.
20 "	98.40 "	Ox Bow, or Mt. Tom Station.
24 "	99.40 "	Northampton Bridge.
32 "	100.00 "	Boundary between Hampshire and Franklin Counties.
38 "	102.00 "	Sunderland Ferry.
43 "	104.00 "	Fitchburg Railroad Bridge.
48 "	170.00 "	Turner's Falls Dam.
59 "	195.00 "	Northern State Line.

In the second column, I have stated the heights of the water surfaces of the river at a low stage of the river above the mean level of the sea, to the best of my information in each case, which in many instances is by no means exact.

On this length of about fifty-nine miles, the river has, then, a fall of some one hundred and fifty-five feet. Its lower reach, from Willimansett Bridge at Holyoke down past Springfield to the Southern State line, and beyond, to the Enfield dam in Connecticut, is a mill pond about sixteen miles long, formed by this dam at Enfield. From Willimansett Bridge up stream to the foot of the Holyoke dam, there are rapids, covering a fall of some twenty-seven feet. The fall at the Holyoke dam is about thirty feet. Thence a mill pond extends up the river some fifteen miles in all. The upper twelve or thirteen miles of this pond are separated from the lower and wider part of it by rapids below Smith's Ferry,—a point about half-way between the cities of Northampton and Holyoke,—and form a part of the pond proper only at certain periods of the low stages of the river; that is to say, on Sundays and holidays, when no water is passing the dam at Holyoke.

When the upper end of a mill pond is not terminated by rapids, but passes insensibly from its more or less ponded state into an ordinary and natural condition of the stream, it is almost impossible to fix its precise up-stream limit. Such limit takes the form of an infinitesimally fine or sharp edge of a wedge of water lying upon the natural surface of the stream beneath it, and may leap at a bound one, two, or half a dozen miles up stream or down stream, according as the water surface, on the obstruction that sets the water back, is elevated or depressed only a few inches. Practically, the Holyoke mill pond ceases at Mt. Tom Station,—though the influence of the Holyoke dam may be traced, at certain stages of the river, many miles further up stream, until it becomes too vague and ill-defined for further observation.

Passing on by the towns of Hatfield, Whately, Sunderland, Deerfield, Montague and Greenfield, the river rises some four or five feet, and meets the rapids and the dam at Turner's Falls. These rapids and dam cover a fall of some sixty-six feet in all. Above Turner's Falls, the mill pond extends some four or five miles up stream to the junction with Miller's River, then come rapids of some ten feet fall, and the river leaves the State at its northern boundary at an elevation of about one hundred and ninety-five feet above the mean level of the sea.

At its low stages, then, the river, on its way through Massachusetts, is little more in profile than two stairway steps. Beginning at the down-stream end, there is first a "tread" of fourteen miles, then a "rise" of fifty-seven feet (the water power at Holyoke), then another "tread" of thirty-four miles, then a "rise" of sixty-six feet (the water power at Turner's Falls), then another "tread" of eleven miles.

It is upon the down-stream half of the thirty-four mile "tread," where the river passes through the famous Hatfield, Hadley and Northampton meadows, that its restlessness causes it to do the constant mischief and damage to its banks, — cutting them first upon the one side and then upon the other, — which has long been a source of injury, and which gives rise to the present complaints. So early as 1689, record is made of the wearing away of the banks of the river, and in 1730 the town of Hadley voted "to do something to prevent the bank from wearing," and chose a committee to call out every man to work one day at the bank and to be paid for it. So again in 1734, and at subsequent dates. (See Judd's History of the Town of Hadley for considerable information on these points.)

Below Holyoke, the river, though ordinarily without material inclination, flows between stable banks. It has carved its way deeply into the soil of the plain through which it flows. The banks are largely composed of gravel, and are overflowed but seldom, say once in twenty or twenty-five years. Above Holyoke to Smith's Ferry, the shores are mostly ledge, and are high until Mt. Tom Station on the Connecticut River Railroad is reached. But above this point up to Sunderland, a dozen miles or more, the river passes through what was no doubt the bed of an ancient, pre-historic lake.

Geologists suppose that, at some former period, only a portion, or none, of the river passed between Mt. Tom and Mt. Holyoke, while the main body of the river was dammed back, and, following the valley now occupied by the New Haven and Northampton Railroad, entered the Sound at about where New Haven now is. At that time, the Northampton and Hadley meadows were the bottom of a lake; Round Hill, in Northampton, was a peninsula or an island; and certain water-marks on the back of Mt. Tom would indicate that this lake had considerable depth. The bottom of the lake naturally formed a place of deposit for river silt; and since the river has been flowing through this deposit of silt, it always has partaken, and at the present time is, of the character of rivers flowing through alluvial territory.

Rivers of this class, in their natural state, are constantly shifting their banks and bed. The shores at one point are wasted away, only to reappear and rise in form of alluvial deposit at another point. Huge serpentines, bends, or ox-bows are formed, which gradually waste away at their narrowest points until the river cuts them through; and, thereupon taking on an unnatural velocity, and one incompatible with the substance of which the bed and banks are composed, the river immediately proceeds to

carve out for itself new serpentines, in turn to be cut through at their narrowest part, and left on one side as half-moon shaped lakes or bayous; and so on *ad infinitum*,—the river meanwhile meandering from one side of the main valley to the other, and generally passing over the whole length and breadth of the valley in its devastating march.

This process may require a longer or shorter period, according to local circumstances. The last cut-off on the Connecticut, in the locality now in question, occurred February 25th, 1840, and destroyed as perfect an example of a serpentine as is often found in alluvial rivers, forming as it did, when completed, an island almost circular in outline. This was at the site of the famous ox-bow at Mt. Tom Station.

The remedy for this condition of things along the river, would be found in the systematic training of the river, and the protection of portions of its banks, until stable and permanent banks had become established,—a branch of civil engineering by no means new, and in some small and disjointed manner already practised, or attempted, on this very part of the river. By chapter 91 of the Resolves of 1846, the General Court made a grant of \$2,750 for this purpose, on condition of a like sum being raised by the Town of Hadley and by private parties most interested; and by chapter 200 of the Acts of 1875, there was further legislation, under which a piece of the river bank near Northampton Bridge was secured from erosion.

Above Sunderland, the character of the banks becomes more stable, until at Montague the river flows again on a bed of rock, and between banks of the same material. Above Turner's Falls, also, there is little or no complaint of the instability of the banks of the river.

In its natural state, and until the end of the last century, the rapids at Enfield Falls in Connecticut, at South Hadley Falls and Turner's Falls in this State, and at several points further north, formed an insuperable barrier to navigation by boats up stream. The first efforts to render the river navigable seem to have been made in 1792, by the incorporation of the Proprietors of the Locks and Canals on Connecticut River (Mass. Special Laws, Vol. 1, p. 329). The canal built by them at South Hadley Falls is not now in use for purposes of navigation, such use having ceased about twenty years ago. At one time, before the introduction of railroads, there seems to have been considerable freighting done upon the river, from Hartford and the Sound up into Vermont and New Hampshire. The property of the Proprietors was sold in 1848, and became the foundation for the works of the Hadley Falls Com-

pany, now the Holyoke Water Power Company. In 1794 (Mass. Special Laws, Vol. 1, p. 515), the interest of the "Proprietors in the Lower Locks" (at South Hadley Falls) was set off from that of the "Proprietors in the Upper Locks," the latter becoming the property of "The Proprietors of the Upper Locks and Canals on Connecticut River," now the Turner's Falls Company.

The "Connecticut River Company" was incorporated in 1824 (Conn. Special Laws, Vol. 1, p. 75), and was to make the river navigable from Hartford upwards, especially at Enfield Falls. Until 1881, this company had a right only to the construction of two wing dams, one jutting out from each shore of the river, and leaving a gap in the channel between them. It had gradually passed in the meantime from a navigation company into a water power company, controlling the water power at Windsor Locks in Connecticut; and, by encroachment upon the channel and otherwise, had dammed back the water for sixteen miles up stream, to the Willimansett Bridge in Holyoke, about a foot and a half higher in 1881 than it did twenty-five years previously.

An Act of the Connecticut Legislature, passed in 1881, undertook to give this company the right to close the gap between the two wing dams, and to raise the whole dam fifteen inches higher still. This was resisted in the Circuit Court of the United States for the District of Connecticut by the Holyoke Water Power Company, by the Dwight Mills of Chicopee, and by the Town of West Springfield; and Judge Shipman, in his opinion filed April 23, 1884, orders "a decree enjoining the defendant against any further raising of its present dam, and against constructing a new dam or dams to a greater height than the height occupied by the respective portions of the present structure." He allows the defendant to keep, however, so much of the fall of the river as it had taken against the protests of the plaintiffs, and even in violation of the first temporary injunction of the Court, and before the proceedings to permanently enjoin such action could be fairly set in motion; which, in times of low water, amounts to about a foot at West Springfield or at Holyoke,—making a total encroachment upon the drainage facilities of Springfield and of West Springfield, and upon the water power of Holyoke, between 1855 and 1882, of about two feet and a half. The loss to the Holyoke Water Power Company, chargeable to this encroachment on its property, cannot be estimated at less than two hundred and fifty thousand dollars; and the damage to the city of Springfield and to the town of West Springfield is likewise a very large sum, when measured as a money damage.

An occasional boat now passes the locks at Enfield Falls, though the chief navigation of the river between Enfield Rapids and Springfield, and from Springfield to Holyoke, is one merely of Sunday or picnic pleasure boats. The relative importance of the navigation and the water-power interests at Enfield Falls, may be judged by a comparison of the tolls received for the one, and the rents received for the other, — which, in 1881, were about \$500 and \$18,000 respectively.

Past Holyoke, as has been stated, there has been no navigation these twenty years; nor is there any to speak of between Holyoke and the northern State line. A steamer ran, until within a year or two, from Mt. Tom Station to the landing of the proprietor of the Mt. Holyoke House, for the accommodation of his guests; and there may be some few pleasure boats at and above Holyoke.

The sole use made of the river at and above Holyoke for business purposes, other than by the water powers at Holyoke and at Turner's Falls, and by the several public ferries, is to float logs down. This is done by the Connecticut River Lumber Company, which was incorporated February 5th, 1878, under a general law of the State of Connecticut. The same parties, under the name of the Holyoke and Northampton Boom and Lumber Company, are chartered in Massachusetts to have booms on the river, by chapter 362 of the Acts of 1871, amended by chapter 215 of the Acts of 1873. The drives of this company, in these days wholly of spruce logs, are cut on the head waters of the river, and are floated, not rafted, down as far as Holyoke. Extensive saw-mills of this company at Holyoke and Mt. Tom Station, and another of another company at Turner's Falls, convert the logs into merchantable lumber. For the purpose of guiding, controlling, and storing the logs, the company makes use of piers, both permanent and temporary, and boom logs extending from pier to pier. These logs, piers, and booms are an obstruction to pleasure and other boating, and to the several ferries; whence more or less complaint and even lawsuits. As the bed and banks of the river are admittedly the private property of the shore proprietors, such piers and booms are now of the nature of unlawful encroachments. It is also claimed that some of these piers cause an abnormal washing away of the banks, or a deposit of silt, as the case may be; on which accounts, it is sought to place their erection and maintenance under State control and regulation.

Alarm has been expressed by some, that the river is undergoing a radical change in some of its physical features, owing to the cutting off of the forests near its head waters, thereby changing the distribution of its flow during the year; it being feared that the

droughts are becoming longer and more severe, while the freshets are becoming quicker and higher. But such observations as are at date available, do not seem to indicate any such effects, whatever may be the diminution or increase of wooded land.

The highest recorded freshet, in records going back to the freshet of February 24th, 1692, occurred in 1854. Other high freshets, in 1801 and in 1862, were nearly as high, the latter at some points even higher. From the fact that the elevation selected for the crest of the dam built in 1849 at the South Hadley Falls, and still standing, was the same as that of the dam built about 1805, one would suppose that no material change had been observed in the régime of the river between 1805 and 1849; and, as we have seen, the greatest freshet on record occurred five years later, in 1854.

The record of extreme low water is not so easily arrived at as that of extreme high water, being more a matter of volume flowing per second in the river, than of absolute elevation of the water surface. From such crude records as have come to my notice, I infer, however, that there was as low water in 1876 as in any year since, unless it were in 1883. It should be remembered, in this connection, that an apparently unprecedented low water, in the case of rivers used for water power, or for the supply of water to cities and towns, is often due to the use or draft of a greater quantity of water than ever before, or greater than at the time of the last recorded great drought. I have seen no records of any value, bearing upon the low-water volume, prior to 1870.

So also in regard to other rivers of the United States, notably the Ohio and Mississippi. A careful study of the records fails to show a change in the régime of those rivers which might be traced as due to the chopping down of the forests. Extreme high-water marks occur at dates before the forests were touched, and there is no proof that the low waters of those days were not equally annoying with the low waters of to-day. The explanation of this seeming anomaly is a simple one. It is the circumstance that, when, in common parlance, forests are spoken of as having been exhausted, the facts in the case are more likely to exhibit an exhaustion, indeed, of all the pine, spruce, and hemlock, — soft woods, which are floatable, — while it will be found that all the hard woods, which are not floatable, and cannot be rafted or “driven” down the rivers, have been left standing; and, together with the underbrush, still form as complete a regulator for the yield or delivery of rain and snow water, as did the original primeval forest.

Such, at all events, has been the case upon the head waters of

the Connecticut River ; and, if I were to give my impression only, I should say that, along the lower reaches of the river, along through the southern portions of Vermont and New Hampshire, and through Massachusetts, there is more woodland, such as it is, to-day than there was forty years ago. This is owing to the more general use of anthracite coals for fuel by the people, to the increased use of soft coals for locomotives and stationary engines, and to the abandonment of the poorer hill farms. But it does not require a handsome, noble forest to regulate the flow of water over the surface of the ground. Mere underbrush will answer this purpose as well. The implement, then, which is to be feared as causing quick floods and long, severe droughts, is not the lumberman's axe, but the farmer's plough, or the grub-hook, used to excess.

There are, indeed, sections of the Old World, in the Pyrenees, in the Appenines, on the island of Corsica, and elsewhere, where the soil of the mountain sides has been washed down into the plains, so great has been the denudation of timber and underbrush ; and where, by this means, all the rivers have become raging mountain torrents. This has been caused largely by the excessive scarcity of every kind of fuel, so that all woods were eagerly sought for that purpose, and by the herding of animals, notably goats, which eat the leaves of the trees and shrubs upon the mountain sides. Once all trees and shrubs either chopped down or killed off, the rains make quick work of such steep declivities, and wide-spread ruin is the consequence. I believe that no such examples exist within the territory of the United States, although forest fires may have produced similar results in some localities.

It will be evident, then, that whether we consider the encroachments of the river upon its banks on the twelve-mile reach above Mt. Tom Station, or other devastation which it is liable to cause at points along this reach ; or whether we consider the irregular construction of piers and booms along and in the bed of the river ; or the question of change in the régime of the river, and how much is to be feared from it ; or questions of drainage facilities for the city of Springfield and the low-lying town of West Springfield,—in every case there appears the need of recorded facts bearing upon the situation or plan, upon the elevation or profile, and upon the varying volume of this river. So much must precede any intelligent action in the premises.

The river has long since been subjected to the uses of man, and leads now, mainly, an artificial existence. By the accident of having principally paper mills along its course, its flow is more

natural than that of other rivers used to drive manufactories,—the Merrimac, for instance. The Connecticut may be called a “paper river,” while the Merrimac is a “cotton river.” The first flows on without interruption by all the dams on its course, for one hundred and forty-four hours in a week, the water being ponded only from Saturday midnight until Sunday midnight; while the Merrimac leaps along in bounds of ten hours of work, followed by fourteen hours of rest or of being ponded. In times of low water, the fluctuations in volume and in elevation of the water surface, which on the Merrimac occur during the space of only ten hours, and on each working day, are on the Connecticut spread over the one hundred and forty-four hours of the six working days of the week,—the normal procedure being to start with a full pond at Sunday midnight, and gradually to exhaust the same, so that low water obtains in the ponds on Fridays and Saturdays and until Saturday midnight; then to allow the pond to fill over Sunday, and to proceed as before; or, in other words, to pass a seven days’ flow of the river by the dam in six days,—thus forcing the river to rest upon the Sabbath day in its course down this long-time orthodox valley.

So much for the way in which the waters of the river are regulated in their flow. But the elevation of the surface of the river, over a large portion of its course, is also wholly artificial; and, to avoid damage to contiguous territory, where the banks do not maintain themselves, artificial banks and training works are necessary. As a natural incident to this complete change from a state of nature to one of art, which this river is gradually undergoing in the course of this century, has come the present agitation in favor of public surveys, levels and observations.

I have had the honor to testify before the Commissioners, and beg to repeat my estimate, based upon a survey and levels made under my direction of some fifteen miles of the river,—that for \$15,000 the State could cause to be surveyed and plotted, on a scale such as to be of service in the investigations now contemplated, the whole of that portion of the river which lies within the Commonwealth, could cause accurate levels to be taken of fixed points along its banks, and could cause daily observations of the water heights obtaining in the river to be taken for four or five years, at four or five characteristic or ruling points.

Submitting the above, I beg to remain,

Very respectfully and faithfully yours,

CLEMENS HERSCHEL,

Civil and Hydraulic Engineer.

HOLYOKE, December 27, 1884.

With the data now at command, little can be added to what is said in the foregoing paper, which would place in a fuller or clearer light the general physical characteristics of the river, or the proper course of action to be taken with a view to its future preservation and improvement.

The devastation of the river, more particularly that portion of it which flows through the alluvial bottom land in Hampshire county, and the practicability of stopping or checking its ravages, have from an early period forced themselves upon the attention, and excited the anxious interest, of the settlers and residents upon its banks. Abundant evidence of this appears on every hand. Mr. Sylvester Judd, who has been styled "the distinguished antiquary of Northampton," and is reputed to have been an accurate observer and historian, in an article published in the "Hampshire Gazette" of May 30, 1832, wrote as follows: —

The Connecticut was a very crooked stream when Northampton, Hadley and Hatfield were settled upwards of 170 years ago, and has been gradually becoming more circuitous from that time to the present. Hatfield south meadow extends farther towards the east and south-east than formerly. The peninsula on which Hadley meadow and village are situated has increased in length by the river's wearing away the bank above and below the isthmus or neck, and the neck has become narrower. Old Rainbow meadow in Northampton has increased in an easterly direction; and Hockanum peninsula in Hadley has almost doubled its length. It appears to us that Hatfield has gained more than it has lost, and that Northampton and Hadley have lost more than they have gained. There is considerable loss that has not been gained by either town. We are inclined to think that the river has increased in width; but, be this as it may, in becoming more circuitous, it covers more acres, and leaves less land in the adjoining meadows.

Northampton meadow has lost near 100 acres on the northerly side or end opposite Aquavitæ meadow in Hadley, but the latter has not gained to an equal extent. The lot in Old Rainbow, called the Hadley School lot, is well known to most of the farmers in Northampton and Hadley. About two-thirds of this lot have been carried away, and a large portion of some lots south of it. When Old Rainbow was laid out, about 1655, there were 12 lots, containing 64 acres, lying north of the School lot, and Old Rain-

bow hill extended in a north-westerly direction about 80 rods beyond the School lot. This is ascertained by the length and width of the lots as given in the records. Now only 30 of these 80 rods remain, about 50 having been washed away. On the other hand, Old Rainbow has gained 20 or 30 rods in an easterly direction. The north-east point of this meadow, which is now opposite the south end of Hadley street, was in former days much farther both west and north. The ferry road agreed upon between the two towns in 1665, struck the river about 30 rods north of the School lot, and the boats, in crossing the river from the meadow to Hadley street, went easterly, instead of proceeding northerly as they now do.

In that part of Northampton meadow called Pynchon's meadow, opposite the end of Hockanum peninsula, the river has gradually worn away the bank until it is now about 70 rods farther west than it was when the land was measured out to John Pynchon 175 years ago. Many people imagine that the river has encroached much more than 70 rods in this place; but it is believed that the old records are more trustworthy than traditions and notions. The distance from the straight path across Pynchon's meadow to the river was 165 rods (liberal measure—perhaps 170 rods) on the north-east side, and 174 rods towards the south-west side. The distance on the north-east side is now 90 rods. The quantity of land carried away from this meadow is not far from 65 acres, and the loss in the adjoining meadows of Hogsbladder and Manhan is probably more than 65 acres.

In 1840, eight years after the above was written, the river cut across the neck of the "Hockanum peninsula," one of the localities to which the writer alludes. This is the same cut-off which is described by Mr. Herschel as occurring at the site of the famous ox-bow at Mt. Tom Station. The river, beginning about 1825, also made a new channel across the "School-meadow" land in the northerly part of Hadley, opposite Hatfield. About 25 years later, controversies arose in regard to the division of the alluvial land which had in the meantime gradually formed in the bed of the old channel, which were determined in the case of the *Trustees of Hopkins Academy v. Dickinson*, 9 Cush. 544, in which an interesting opinion is given by Chief Justice Shaw.

In his History of Hadley, published in 1863 and referred to by Mr. Herschel, Mr. Judd says:—

The town passed many votes, in the last and present century, "to prevent the river from wearing the bank" at the north end of the village. They built wharves of stone and timber, and retarded the progress of the wearing off, but did not stop it. In 1801, they began to defend the bank against Fort meadow. * * * The river has made extensive inroads above Northampton bridge, upon the western and northern sides of the Great meadow; also upon the uplands above and below Hadley Village, opposite Hatfield and Northampton meadows, and at Fort meadow. The roads have been removed eastward several times.

Speaking of another locality, he says:—

Opposite to this grass meadow, the inroads of the river upon Hadley have been destructive. The homesteads where some of the early settlers lived and died, the land which they cultivated, and the highways which they travelled, have been carried away, and more serious consequences have been threatened.

The above are only a few of the instances which might be cited from the same and other authorities to show the wearing and devastation of the river years ago. The observation of living witnesses would supply as many of more recent date. Col. Edwards, the chairman of the county commissioners of Hampshire county, pointed out to this Board, upon a view of the locality, a highway leading southerly from Hadley Village, on the east bank of the river, at or near Fort meadow, which has been moved further to the eastward three times during the term of his official service. He stated that, in order to avoid the too frequent and costly repetition of this process, the road was moved the last time a considerably longer distance to the eastward than before; but the river is evidently making haste to overtake and obliterate this last location, as it has already swept away all those preceding it, before as well as during the period of which Col. Edwards speaks.

Mr. Judd, in one of the passages cited above from his History of Hadley, speaks of the extensive inroads which the river had made on its banks on the Hadley side above Northampton bridge. Previous to 1875, the bank had been so worn away at the Hadley end of this bridge as to require

the addition of one or more spans to the bridge, and a new shore abutment. This abutment being endangered by the continued wearing of the bank, and the shore abutment of the new Massachusetts Central Railroad bridge, a few rods above, being already undermined and separated from the shore, the county commissioners of Hampshire county were directed, by chapter 200 of the Acts of 1875, to construct proper defences above these bridges to prevent the washing away of the bank, the cost of the work to be paid out of the county treasury, and afterwards to be assessed upon such towns, persons and corporations, and in such proportions, as commissioners to be appointed by the supreme judicial court should determine. The work done by the county commissioners under this act, with the advice of eminent engineers, has thus far proved successful in accomplishing the result intended; and the original cost, some \$8,000, with the accrued interest, has been recently apportioned under the act. It is stated that, owing to the want of data to determine the low-water mark of the river, the piles supporting the abutment of the railroad bridge were cut off so high as to expose their upper ends at extreme low stages of the river.

It was supposed, from some intimations which had come to the Board, that an attempt would be made to connect the severity of the floods and droughts in the river with the cutting off of the forests at its head waters and along its valley; but no such theory was urged, and the facts and reasonings of Mr. Herschel upon this part of the case seem to be so well-sustained as apparently to leave nothing to be added to the discussion of this interesting problem, so far, at least, as this river is concerned.

That the restlessness and aggressions of the river have been the occasion of much damage and loss both to public and private property and interests, seems to require no further statement or proof. Its ravages are still going on with apparently undiminished energy, however the points of attack may have changed. The river, it is true, makes some restitution for the injury it does. It builds up as well as destroys. But the work of repair is slow, and the net result a loss. The newly made land, though often highly pro-

ductive of vegetation, must require centuries before, if ever, it rises to a level above the periodical sweep of the floods, and becomes suitable for building and habitation; and it remains always exposed to the fresh attacks of the river. As capricious in repairing as in doing mischief, the river thus makes partial and tardy compensation to one for the full and quick injury it has done to another. . In an almost literal sense, it gives to him that hath, and from him that hath not, takes away even that which he seemeth to have.

So long as the river is allowed to roam uncontrolled, it will continue to be the source of serious damage and apprehension; and, obeying the instincts which Mr. Herschel attributes to rivers of its class, will not unlikely, in the course of time, pass over "the whole length and breadth of the valley in its devastating march." That it may be controlled by the science and art of man, or, if not sought to be wholly controlled, checked at the points of greatest danger, fortunately admits of no doubt. Such work is not, however, to be undertaken at random; and it is in this view that a scientific survey and observations of the river are now proposed. It is admitted and urged by all parties in interest that this is the first step to be taken; and the Board is so instructed by the able experts whose advice it has sought. There can be no question that such survey and observations would be of essential and indispensable value in determining what the present or future exigencies of the case may require to be done "for the preservation and improvement of said river, and for the protection of all interests connected therewith."

It was suggested that a survey of the river might be undertaken in connection with the geological and contour topographical survey of the Commonwealth now in progress under the joint direction or co-operation of the director or representative of the United States and the commission appointed to act on behalf of this State under chapter 72 of the Resolves of 1884. Whether such further combination of work could be advantageously made, or would conveniently secure the greater accuracy and minuteness which might be found desirable in some of the details of the river

survey, — is a point on which this Board has not undertaken to form a definite opinion ; and it is respectfully referred, with the more important questions and interests involved in the subject matter of the conservation of this river, to the careful consideration of the legislature.

JOHN E. SANFORD.

JOHN I. BAKER.

JOSEPH K. BAKER.

Boston, January 1, 1885.

APPENDIX.

APPENDIX.

[A.]

[See page 7 of this Report, *ante*.]

AN AGREEMENT, MADE THIS TWENTIETH DAY OF JUNE, 1884, BY
AND BETWEEN THE NEW ENGLAND DREDGING COMPANY, PARTY
OF THE FIRST PART, AND THE COMMONWEALTH OF MASSACHUSETTS,
PARTY OF THE SECOND PART.

WHEREAS, the said parties have heretofore, to wit, on the twelfth day of August, 1881, entered into certain Articles of Agreement in relation to the dredging of certain material and the depositing of the same on certain flats in South Boston, which articles of agreement are to be referred to as a part hereof;

It is hereby further agreed by the said parties, that the said articles of agreement shall be and are hereby so modified and extended, that the said party of the first part shall, in addition to the areas of flats in said articles described, fill with the dredged material to grade 13 a further area, or so much thereof as shall remain unfilled when the material now deposited thereon has been levelled to grade 13, bounded as follows, to wit: Northerly by the area first described in the articles of agreement aforesaid; Westerly by B Street; Southerly by the strip along the northerly side of Cypher Street already filled to grade 13 with ashes; and Easterly by the centre line of tramway No. 2 built by said party of the first part between B and C streets, being the second tramway from B Street.

All the terms, provisions and conditions set forth in the aforesaid articles of agreement, and applicable to the first area therein described, shall apply to the further area herein described; *provided, however*, and it is understood and agreed, that both of the areas described in said articles of agreement, and the further area herein described, shall all be filled and completed to grade 13 by said party of the first part, notwithstanding any mention in the said articles of a specific number of cubic yards of material to be dredged by said party of the first part; and that all the work to

be done as aforesaid on the further area herein described, shall be completed by said party of the first part before the first day of November, 1884.

AND, WHEREAS, the said parties have also heretofore, to wit, on the first day of July, 1882, entered into certain other Articles of Agreement in relation to material dredged by other parties, and the depositing of the same by the party of the first part on a certain other area of flats in South Boston, which last named articles of agreement are also to be referred to as a part hereof;

AND, WHEREAS, the said last named articles of agreement by the terms thereof expire on the eighteenth day of August, 1884;

It is hereby further agreed by the said parties of the first and second parts, that the said last named articles of agreement shall be and hereby are extended and continued in force for a further term of one year, so as to expire on the eighteenth day of August, 1885, subject to all the terms, provisions and conditions thereof, except as regards time of expiration; and *provided, also*, that from and after the thirteenth day of June, 1884, there shall be substituted for the area in said last named articles specified and described, a certain other and smaller area, being a part of the former, bounded as follows, to wit; Northerly by the southerly boundary line of the area first described in the articles of agreement first above named, dated August 12, 1881; Southerly by a line drawn parallel to and five hundred and fifty feet distant southerly from said southerly boundary line; Easterly, by a line drawn one hundred feet east of and parallel to the easterly line of D Street extended; and Westerly by the centre line of tramway No. 2 hereinbefore mentioned and described.

Nothing herein contained shall be so construed as to change or impair any of the provisions of either of the aforesaid Articles of Agreement, dated respectively August 12, 1881, and July 1, 1882, except so far as they are modified by the express provisions of this agreement.

In witness whereof, the said NEW ENGLAND DREDGING COMPANY, by Charles H. Souther, its President and Treasurer, thereunto duly authorized, has caused its corporate seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf; And the said COMMONWEALTH, acting by its Board of Harbor and Land Commissioners, has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf,

the day and year first above written, and the same to be approved by its Governor and Council.

NEW ENGLAND DREDGING COMPANY,

BY CHARLES H. SOUTHER, [SEAL OF THE NEW ENGLAND
DREDGING CO.]
President and Treasurer.

• THE COMMONWEALTH OF MASSACHUSETTS,

BY JOHN E. SANFORD, } *Harbor and*
HENRY L. WHITING, } *Land*
JOHN I. BAKER, } *Commissioners.*

Witness the Seal of the Commonwealth, [SEAL OF THE
COMMONWEALTH.]
HENRY B. PEIRCE, *Secretary of the Commonwealth.*

In Council, July 3, 1884. Approved.

HENRY B. PEIRCE, *Secretary.*

[B.]

[See page 14 of this Report, *ante*.]

AN AGREEMENT BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS AND THE BOSTON AND ROXBURY MILL CORPORATION.

THIS AGREEMENT, in the form of an Indenture of two parts, made and executed this fifth day of May, in the year eighteen hundred and eighty-four, by and between the COMMONWEALTH OF MASSACHUSETTS, acting by John E. Sanford, Henry L. Whiting and John I. Baker, its Harbor and Land Commissioners, under the authority conferred on said Commissioners by chapter 51 of the Resolves of the year aforesaid, entitled a "Resolve in relation to the Indenture between the Commonwealth and the Boston and Roxbury Mill Corporation, and the Mortgage of said Corporation to the Commonwealth," PARTY OF THE FIRST PART, and the BOSTON AND ROXBURY MILL CORPORATION, a Corporation established under the laws of said Commonwealth, PARTY OF THE SECOND PART, Witnesseth :

The said party of the first part, subject, however, to the approval of the Governor and Council, and the said party of the second part, do hereby mutually agree, each with the other, as follows :—

Such a construction shall be and is hereby given to the second article of the Indenture, dated the ninth day of June in the year eighteen hundred and fifty four, made by and between said Commonwealth, party of the first part, and said Corporation, party of the second part, that the space inclosed, or to be inclosed, by the sea wall mentioned in said article, excepting the streets and avenues in such space, shall be deemed filled to the height of the mill dam, within the meaning of said article, when filled to the height of grade *thirteen* (13) ; and that such streets and avenues shall be deemed so filled when filled to a grade satisfactory to said Harbor and Land Commissioners, or their successors in office or authority, but not less than grade *fourteen* (14) ; and the Mortgage of said Corporation to said Commonwealth, of the same date as said indenture, shall be and is hereby so modified that the Treasurer and Receiver General shall, subject in other respects to the provisions of said mortgage, release and convey to said Corporation portions of the land included in said mortgage in advance of contracts to sell and convey, instead of releasing and conveying to purchasers

with whom said Corporation has contracted to sell and convey as provided in said mortgage; *provided, however*, that nothing in this agreement shall affect the obligation of the Commonwealth to release to purchasers, in the manner in said mortgage provided, any portions of said land not released to said Corporation as aforesaid; and *provided, also*, that nothing herein contained shall be so construed as to change or impair the force of any of the terms, conditions and provisions of the Indenture or Mortgage aforesaid, except so far as the same are modified by the express provisions of this Indenture.

IN WITNESS WHEREOF, on the day and year first above written, the said COMMONWEALTH OF MASSACHUSETTS, acting by its Harbor and Land Commissioners as aforesaid, hath caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and hath also caused these presents to be approved by its Governor and Council; and the said BOSTON AND ROXBURY MILL CORPORATION, by Charles Henry Parker, its President, thereunto duly authorized by vote of its Directors, a copy of which vote is hereunto annexed, hath caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and*
HENRY L. WHITING, } *Land*
JOHN I. BAKER, } *Commissioners.*

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

HENRY B. PEIRCE, *Secretary of the Commonwealth.*

BOSTON AND ROXBURY MILL CORPORATION,

By CHAS. HENRY PARKER,

[SEAL OF THE BOSTON AND ROXBURY
MILL CORPORATION.]

President.

Signed, sealed and delivered in presence of

HERBERT MAGOUN to C. H. P.

Suffolk, ss. Boston, June 23, 1884. Then personally appeared the above named Charles Henry Parker and acknowledged the fore-

going instrument to be the free act and deed of the Boston and Roxbury Mill Corporation, before me.

HERBERT MAGOUN, *Justice of the Peace.*

[COPY.]

At a meeting of the Directors of the Boston and Roxbury Mill Corporation, held according to legal notice at the office of the Corporation in Boston, on Saturday, the twenty-first day of June, 1884, an Indenture with the Commonwealth of Massachusetts having been read, it was voted; That the President, Charles Henry Parker, is hereby authorized and instructed to execute, acknowledge and deliver, in the name and behalf of the Corporation, the Indenture, dated May 5th, 1884, between the Commonwealth and the Corporation which has just been read.

I hereby certify that the foregoing is a true copy from the Records of the Boston and Roxbury Mill Corporation, and that the within instrument is the Indenture read at the meeting and referred to in the vote.

JOHN A. BENNETT, *Clerk of the Corporation.*

In Council, July 3, 1884. Approved.

HENRY B. PEIRCE, *Secretary.*

ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS

FOR

THE YEAR 1885.

BOSTON:
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1886.

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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

*To the Honorable the Senate and the House of Representatives of the
Commonwealth of Massachusetts.*

The Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submits its Annual Report for the year 1885.

BACK BAY LANDS.

The general court, by chapter 201 of the acts of 1885, granted to the city of Boston the "perpetual right to hold, occupy and control, free of rent or charge by the Commonwealth, for the purpose of erecting and maintaining thereon a school building to be used for the education of deaf mutes and deaf children," a parcel of land on the Back Bay, situate on the southerly side of Newbury Street between Dartmouth and Exeter streets, containing 8,400 square feet, and worth, at a selling price of \$3.50 per foot, \$29,400. This grant was made "subject to the following stipulations, namely:—the city of Boston shall, within three years from the date of the passage of this act [April 29, 1885], erect on the said parcel of land a school building suitable for the use of the Horace Mann School for the Deaf, and shall thereafter maintain said school for the education of deaf mutes and deaf children who shall be sent to said school by the governor, with the approval of the board of education, or shall otherwise be lawfully sent to or received by the said school for

instruction therein; and shall, in respect to the erection of said building, be subject to the restrictions heretofore contained in other conveyances by the Commonwealth of its land on Newbury Street."

In accordance with the provisions of chapter 330 of the acts of 1885, this Board on the 9th day of July last conveyed to the state board of education and its successors, in trust for the Commonwealth, for the use of the State Normal Art School, another parcel of land on the Back Bay, situate at the southwesterly corner of Newbury and Exeter streets, containing 15,568 square feet, and worth, at a selling price of \$4.00 per foot, \$62,272. This land had been reserved from sale for this purpose under chapter 223 of the acts of 1880 and chapter 128 of the acts of 1883, and is, by the terms of the grant, to be used only for the erection of a "suitable building for the use of the State Normal Art School," with a stipulation that "the plans for said building shall conform to the restrictions contained in the deeds heretofore given by the Commonwealth to private purchasers of land on Newbury Street and Exeter Street."

These are valuable gifts, and have the effect of diverting considerable sums of money from the treasury and from sinking funds to which the proceeds of public lands are pledged by law. They are, however, gifts for meritorious public uses, and these uses are clearly defined, and the appropriation to other uses is expressly or by clear implication forbidden. In this respect, these grants conform to the usual and only defensible policy and method of making donations of public property.

There has been but one instance, at least in recent legislation, in which a valuable grant of public land has been made as a gift without being coupled with an express limitation to public uses clearly defined in the grant. This was the act of 1884, chapter 327, giving to the city of Boston the right to build a pile structure upon a tract of the tide-water lands of the Commonwealth in Charles River. The objections to the character and form of this grant were forcibly stated by Governor Robinson in his message returning the bill to the legislature for reconsideration, in which he says:—

The bill gives to the city of Boston, without payment of money or compensation of any kind, a perpetual right to occupy with a pile structure an area of tide-water lands in the Charles River, lying between the new Warren Bridge and the bridge of the Fitchburg Railroad Company, containing 26,932 square feet, and having a market value at the price recently received by the Commonwealth for similar grants in the immediate vicinity (seventy-five cents per square foot) of \$20,199. Other estimates fix a much larger sum as its real value. * * * The entire area is tide-water land, the title of which is in the Commonwealth. * * *

Under ordinary grants of this character the Public Statutes, chapter 19, sections 14 and 16, require not only compensation to be made for tide water displaced, but the payment into the treasury by the grantee, for the rights and privileges granted in the land of the Commonwealth, of such sums of money as the governor and council shall determine to be just and equitable. An exception is made if the grant is to a city, town or county for a bridge constituting a part of a public highway; and under this exception the city of Boston has lately occupied, without payment, for the new Warren Bridge over the Charles River, an area of 47,520 square feet of tide-water land of the Commonwealth in excess of the area occupied by the old bridge, the market value of which, at the price already stated, would be \$35,640.

The legislature has also in special cases made gifts of public land for other public uses. More than two-fifths of the Commonwealth's lands on the Back Bay were thus devoted to public avenues, streets and ways, and nearly one-seventh of the residue reserved for sale has been donated to the city of Boston and to public institutions. It has been the custom in making such gifts to define the public uses for which the land was granted, and, expressly or by implication, to forbid the appropriation to other uses. * * *

It may be said to be the settled policy of the Commonwealth that the public lands are not to be granted for other than public purposes except upon fair and reasonable compensation, and that, in donating portions of the public domain for public uses without such compensation, the uses should be clearly defined in the grant. It would be difficult to justify any other system of dealing with the public lands of the Commonwealth.

The bill under consideration is open to the objection that it gives a perpetual right to occupy with a structure a valuable tract of public land, not only without compensation, but without prescribing any public or other use to which it shall be appropriated. There is no restriction which precludes the use of the structure for

purposes of gain, trade, business or profit, or any other purpose for which private property may be used; and, taken in connection with the provisions of chapter 140 of the Acts of 1883, this bill might serve to perfect an absolute title, or lay the foundation to a claim for such a title, to the land in question, so that it could be conveyed by the city to private parties for the purposes of trade or business.

Other serious objections to the bill were urged in the message, especially the injury to the harbor by the further obstruction of the mouth of Charles River; but the bill became a law under somewhat peculiar circumstances on the last day of the session, the objections of the Governor to the contrary notwithstanding.

The apprehensions which were entertained by the Governor of a perversion of the Commonwealth's gift to other than public uses, have proved to be well founded. It appears by the record in the Suffolk registry of deeds, that the city of Boston, in less than seven months after the passage of the act, conveyed to the Fitchburg Railroad Company, under the form of a lease for 999 years, without any restrictions upon the manner of use or power of disposition, all the land and privileges vested in the city by the grant in question, in consideration of the payment by the lessee of the taxes to be levied on the premises during the term. This result forcibly illustrates the soundness of the views expressed in the message of the Governor, and suggests the wisdom of avoiding this act as a precedent for future unguarded donations of the public domain.

Returning from this digression, — the sales of Back Bay lands during the year 1885 have been as follows: —

5,824 feet on Boylston Street, north side, for	.	.	.	\$23,296 00
9,450 feet on Boylston Street, south side, for	.	.	.	34,650 00
<hr/>				<hr/>
15,274 feet in all, sold for	.	.	.	\$57,946 00

The sale on the south side of Boylston Street, 9,450 feet, includes the passage-way in rear of the lot, 1,575 feet, sold under chapter 22 of the resolves of 1879.

The land still unsold, and for which it is estimated that the sum of not less than \$48,000 will be obtained, is located as follows:—

	FEET.
On Boylston Street, north side,	5,824
Marlborough Street, north side,	5,320
Total unsold,	<u>11,144</u>

Although so small an area remains unsold, the title to considerable tracts of land on the Back Bay is still in the Commonwealth. A bond for a deed is usually given by the Commonwealth at the time of sale, and the purchaser does not receive a deed of conveyance until the payments stipulated in the bond have been fully made and the deed is called for.

The following statement shows the sales and other disposition of the Back Bay lands, the gross receipts and expenditures, and the net proceeds on account of the same, from the beginning of the enterprise to the present time:—

In 1857, the Commonwealth owned on the Back Bay, . -	FEET.	4,723,998
Donated, as per last Report,	FEET.	363,308.00
Donated in 1885,		8,400.00
		<u>371,708.00</u>
Devoted to streets and passageways,		2,035,493 60
Sold, as per last Report,		\$2,290,378.40
Sold in 1885,		15,274.00
		<u>2,305,652.40</u>
Remaining for sale December 31, 1885,		11,144.00
		<u>4,723,998</u>
Gross proceeds of land sold, as per last Report,		\$4,975,317 42
Gross proceeds of land sold in 1885,		57,946 00
		<u>\$5,033,263 42</u>
Rights in Parker Street sold, as per last Report,		2,300 00
		<u>\$5,035,563 42</u>
Cost of filling, grading, curbstones, etc., as per last Report,		\$1,627,632 27
Cost of auction sales, as per last Report,		14 291 78
		<u>1,641,924 05</u>
Net proceeds to December 31, 1885,		\$3,393,639 37

It appears that the net amount received by the Commonwealth from the sale of its lands on the Back Bay, up to December 31, 1885, after deducting the cost of filling and improvement and the expenses of auction sales, is \$3,393,-639.37. The average price per foot of all the Back Bay lands sold to date, is \$2.183. The average price of the sales for some years past exceeds \$4.00 per foot.

RESTRICTIONS IN THE BACK BAY DEEDS.

The deeds by which the Commonwealth has conveyed its lands on the Back Bay, have contained with substantial uniformity the following restrictions : —

This conveyance is made upon the following stipulations and agreement :

1. That any building erected on the premises shall be at least three stories high for the main part thereof, and shall not, in any event, be used for a stable, or for any mechanical, [mercantile, *if the building is on Commonwealth Avenue,*] or manufacturing purposes.

2. That the front wall thereof, on [avenue or street], shall be set back [twenty, twenty-two, or twenty-five, *according to location,*] feet from said [avenue or street] ; *provided*, that steps, windows, porticoes, and other usual projections, appurtenant to said front wall, are to be allowed in this reserved space of [twenty, twenty-two, or twenty-five] feet, subject to the following limitations, namely :

First, that no projection of any kind (other than doorsteps and balustrades connected therewith, and also cornices at the roof of the building), will be allowed to extend more than five feet from said front wall into said space ; and

Second, that no projection in the nature of a bay-window, circular front, or octagon front, with the foundation wall sustaining the same (such foundation wall being a projection of the front wall), will be allowed, unless any horizontal section of such projection would fall within the external lines of a trapezoid whose base upon the rear line of the aforesaid space does not exceed seven-tenths of the whole front of the building, nor exceed eighteen feet in any case, and whose side lines make an angle of forty-five degrees with the base ; and each house in a block shall be considered a separate building within the meaning of this limitation.

3 That the streets in said Back Bay on which said premises bound shall be filled up and graded, and the curbstones set, and

the gutters thereof paved, by the Commonwealth, and that the same shall be for ever kept open to be used for all the purposes for which public highways may be lawfully used: *provided*, that the owners of said lands for the time being shall have the right to cultivate trees in the sidewalks in front thereof, leaving a distance of not less than ten feet between the front lines of the lots and such trees.

4. That no cellar or lower floor of any building shall be placed more than four feet below the level of the mill-dam, as fixed by the top surface of the hammered stone at the south-easterly corner of the emptying sluices.

5. That a passage-way, [sixteen or twenty-five, *according to location*,] feet wide, is to be laid out in the rear of the premises, the same to be filled in by the Commonwealth, and to be kept open and maintained by the abutters in common, subject only to the reserved right of making and maintaining a common sewer through the same, for the purpose of draining the lands and streets which may be conveniently drained thereby; that the Commonwealth will build, or cause to be built, the common sewer in said passage-way, and charge to each lot abutting one-half of the expense of constructing the portion of the sewer opposite to each lot,— such sewer to be extended as the land shall be filled, and to be maintained by said Commonwealth, but at the expense of said abutters, until the same is accepted by the city in which the same may be laid.

6. And said Commonwealth reserves the right to enter upon the premises by its agents and, at the expense of the party at fault, to remove or alter, in conformity with the above stipulations, any building, or portion thereof, which may be erected on the premises by the said grantee, or his representatives or assigns, in a manner, or to a use, contrary to the above stipulations.

In its Report for the year 1883, pages 5 to 22, for reasons there stated, the Board devoted considerable space to a careful study of such of these restrictions as bear more directly upon the manner of the erection and use of buildings on the Back Bay. An attempt was made to reduce the stipulations of the deed to a system of plain and intelligible rules for such erection and use, and to set forth the rights and remedies of parties in case of a violation of the stipulations. No reason has appeared for a revision of the views then expressed, and it is not proposed to restate them here.

The Board has since had, however, occasion to consider more pointedly the relations of the Commonwealth to the

Back Bay lands by reason of the restrictions in its deeds, and also its own duties, as the officers or agents of the Commonwealth designated for that purpose, in regard to the enforcement of these restrictions.

When the Commonwealth undertook some thirty years ago the reclamation of its tide-water lands in the Back Bay district, two objects were had in view, — to make the work a great public improvement, and at the same time a source of large pecuniary returns to the treasury. Fortunately neither purpose stood in the way of the other, and both have been carried out with marked success. The Public Garden, Commonwealth Avenue, the liberal system of parallel and intersecting streets and passage-ways, and other features too familiar to need description, attest the wisdom, taste and foresight with which the work was planned. The net round sum of \$3,500,000 accruing to the treasury, to say nothing of donations of generous parcels of land from the sale of which \$550,000 more might easily have been realized, demonstrates its financial success.

In disposing of the blocks of land reserved for sale, bounded on the front by spacious avenues and streets, and in the rear by passage-ways less essential to the plan only in degree, the Commonwealth as owner and grantor had the opportunity, by the insertion in all of its deeds of suitable and uniform restrictions running with the land, to put it beyond a peradventure that these avenues, streets and passage-ways as laid out should continue for all time without obstruction or encroachment; and also, by the same means, to determine forever the character of the occupation of the whole territory to be covered by its deeds, as regards the location, height, projections and general features of all buildings to be erected thereon, and the purposes for which they might be used.

The Commonwealth, as we have seen, took advantage of its opportunity. It framed its deeds with both of these objects distinctly in view. It did not stop there. Indentures were entered into and arrangements made with the Boston Water Power Company and other owners of Back Bay lands, by means of which its own system of avenues, streets and passage-ways was extended under mutual obliga-

tions over large areas of adjoining territory, and substantially the whole Back Bay district became subject to the same or similar restrictions in regard to the manner of laying out, occupation and use.

These measures were wisely taken for the public convenience and comfort, and were highly conducive to elegance and beauty of effect; but they were not inspired by public spirit or sentiment alone. A strict eye was had to the pecuniary results. The plans and restrictions adopted were admirably suited and were intended to make the land desirable to buyers. Every purchaser of a lot was in this way assured that his surroundings over a large territory could never become objectionable. The Back Bay, as compared with any district of its extent within the limits of a populous city, was thus made a place of unsurpassed attractiveness for residence, for institutions devoted to religion, charity, education, science and art, and for all kindred uses. As the direct and intended result, the Commonwealth was enabled to ask, and purchasers were induced to pay, large and highly remunerative prices for the land. The owner of a Back Bay lot may justly say of his privileges under the deed of the Commonwealth, as the chief captain said of his rights as a Roman citizen, — With a great sum obtained I this freedom.

Now it is to be observed that the conditions which attach to the ownership, occupation and use of the Back Bay lands, so far as they differ from and are more desirable than those which attach to land in general, are not due to any statute laws or municipal regulations having a local and special application to the Back Bay district, but solely to the restrictions in the deeds by which these lands have been conveyed; and the advantages thus obtained can be kept only by maintaining these restrictions.

It is equally important to observe that the Commonwealth stands in an essentially different relation to these lands from that which it sustains to lands in general. As a sovereign, it has the right to direct and control within certain limits the use by the owner of all private property, by means of laws in the nature of police regulations designed to protect the public health or prevent an injury to citizens at large; and such laws it may amend or repeal at pleasure. But to the

grantees of its lands on the Back Bay, and to the owners of adjoining land with whom it has entered into covenant, the Commonwealth stands not only in the relation of a sovereign, but also in the relation of a party to a contract; and not even the legislature can impair the obligations of the contract. As a party to a contract, the Commonwealth has no advantage over a private person. It is as fully bound in law and in good conscience as the humblest citizen. It cannot, for example, discontinue or obstruct any of the avenues, streets or passage ways laid down on the plans which it has made by reference and description a part of its deed, or by legislation or otherwise authorize it to be done, in any manner contrary to the stipulations of the deed, any more than can the abuttor who holds the deed.

The Commonwealth has expressly reserved in its deeds the right to enter by its agents for the summary enforcement of the restrictions which govern the erection and use of buildings.* That this reservation was not made for its own benefit alone, but for the benefit of its grantees as well, is evident from the extraordinary statute of 1866, now section 5 of chapter 19 of the Public Statutes, authorizing any grantee under a Back Bay deed, by a proceeding in equity, *to compel* this Board to exercise this reserved right of entry upon the premises of any other grantee, and to remove or alter any building there erected or used in a manner contrary to the restrictions. A grantee who would avail himself of this or any other remedy open to him in his own name, must, however, be watchful and alert. He must not sleep upon his rights. He must not be guilty of *laches*. He must be willing to incur the odium of going to law against his neighbor, and to become in some sense a public prosecutor.

The course of legislation and dealing in regard to these lands has, on the other hand, tended to justify the expectation, and to hold out the inducement to purchasers, that the Commonwealth would itself use for their protection the summary power reserved to it in the deed, or remedies open to it in the courts not less effectual, and in the exercise of

* See clause 6 of Restrictions, *ante*, page 11.

which it is not hampered by the legal limitations or the moral embarrassments of the individual owner. It may be fairly urged that upon this understanding they have bought and paid for their estates. The great majority of them have complied strictly with the provisions of their deeds, and the Commonwealth seems to be bound in good faith to afford them a just and adequate protection against encroachments by other grantees less observant of their common obligations.

Honor and good faith apart, the officers of the Commonwealth would hardly subserve its interests by practically saying to these grantees, "We have sold our lands and got the money for them. We propose to wash our hands of any further trouble about the stipulations in your deeds." It is true that the Commonwealth has disposed of nearly the whole of its 100 acres or more of land on the Back Bay; but it still has more than five times that quantity of land to sell on the South Boston flats, to say nothing of other tide-water lands in Boston harbor and elsewhere. It may probably enhance the price of these lands to sell them under restrictions beneficial to the grantee. There can be no better recommendation of the Commonwealth's deed in the future than the fact that it has scrupulously kept good faith with its grantees in the past. Any action or legislation which should tend to break down any of the restrictions in the Back Bay deeds, or to annul or impair any of the existing remedies for their enforcement, would not only savor of bad faith, but would be a grave mistake as a matter of business policy.

These remedies are not to be used officiously, or otherwise than for the protection of interests fairly entitled to and claiming such protection. No officer of the Commonwealth, it is believed, has ever interposed upon his own motion, or upon the suggestion of any person whose motive was malice, blackmail, or speculation in land. But when a just occasion for action has been shown by parties having interests at stake, or having the general interest at heart, this Board has not thought it necessary or proper to wait for a proceeding in equity to be brought against it under the statute before referred to, *to compel* it to do its plain duty in the premises.

Stables on the Back Bay.

The form of deed adopted for the conveyance of the Back Bay lots contained, as we have seen, the restriction “*That any building erected on the premises * * * shall not, in any event, be used for a stable.*” In about twenty of the earlier deeds, the words “*except a private stable*” were added. All the rest of the deeds have contained the absolute prohibition. In commenting on the prohibited uses of buildings in the Report for 1883 before referred to, it was said in regard to the use for stables : —

On the 27th of November, 1858, the Commissioners on the Back Bay passed the following vote, which is copied from their records : — “*Voted, That it is understood that the Commonwealth will not enforce the stipulation and agreement of the deed, that buildings erected on the Back Bay shall not, in any event, be used for a stable, in such manner as to prevent the erection and use of private stables by gentlemen as appurtenances to their own dwelling houses ; provided, such stables are so constructed and used as not to be justly offensive to the occupants of the surrounding buildings.*”

All of the printed Catalogues prepared and used in connection with the several auction sales of Back Bay lots, have contained a copy of the deed proposed to be given to purchasers, in the usual form, with a note appended, and a reference to the note at the word *stable*, as follows : — “*It is understood that the Commonwealth will not enforce the stipulation and agreement of the deed, that buildings erected upon the Back Bay shall not, in any event, be used for a stable, in such a manner as to prevent the erection and use of private stables by purchasers as appurtenances to their residences ; provided, such stables are so constructed and used as not to be justly offensive to the occupants of the surrounding buildings.*”

With a few exceptions, the foregoing vote and catalogue note have not been embodied in the deeds given to purchasers, whether at public or private sale, either in terms, in substance, or by any reference thereto. How far the absolute prohibition of use for a stable, in a deed given in the usual form, may be qualified, in point of law, by these extraneous memoranda, *query*. Their purport as a collateral agreement is, that the Commonwealth, the grantor, will forbear to enforce the restriction regarding stables according to the strict letter of the deed. The deed itself gives no notice of such agreement to forbear. Assuming that the Commonwealth is

bound, it may be a question how far the right of grantees under such deeds to enforce the restriction as against each other, as hereafter explained, is thereby abridged, — so far, at least, as purchasers at private sale, without express or actual notice of the collateral agreement, are concerned.

If the right to a stable exists in any case, such stable

- (1) Must be strictly a private stable.
- (2) Must be used by the owner or occupant of a dwelling house on the same premises as an appurtenance to such dwelling house.
- (3) Must be so erected and used as not to be justly offensive to the occupants of the surrounding buildings.

A case involving a question of the right of one owner of a Back Bay lot to restrain by bill in equity the owner of another lot from using a building thereon as a private stable, has since been decided by the supreme judicial court. This was the case of *William Beals v. James B. Case & wife*, 138 Mass. 138, in which it was held by a majority of the court that, upon the facts appearing in the case, the plaintiff had failed to show any right to restrain the defendants from using, in a proper manner, as a private stable, the building on their lot. The facts on which the case was decided are stated in the following Opinion of the Court, delivered by Chief Justice Morton : —

The plaintiff is the owner of a lot of land with a dwelling house thereon, on Newbury Street in Boston, between Clarendon Street and Dartmouth Street; the defendants are the owners of a lot with a dwelling-house thereon on Commonwealth Avenue. The two lots adjoin in the rear, the line of each being the centre line of a passage-way, feet sixteen wide, over which each has a right of way. Both parties derive their titles from the Commonwealth: the plaintiff, under a deed to one Morse, dated in July, 1869; and the defendants, under deeds to one Reed and one Daggett, dated respectively in March, 1867, and in May, 1871. The deeds from the Commonwealth under which the defendants derive their title contain the stipulation “that any building erected on the premises shall be at least three stories high for the main part thereof, and shall not in any event be used as a stable, or for any mechanical, mercantile, or manufacturing purposes.”

The deed under which the plaintiff claims contains the same stipulation, except that the word “mercantile” is left out. All the deeds contain the provision that the “said Commonwealth re-

serves the right to enter upon the premises by its agents and, at the expense of the party at fault, to remove or alter, in conformity with the above stipulations, any building or portion thereof which may be erected on the premises by the said grantees, or their representatives or assigns, in a manner or to a use contrary to the above stipulations."

The plaintiff by this bill in equity seeks to restrain the defendants from using as a private stable a building erected by them on the rear part of their lot.

The plaintiff's deed contains no provisions which give him the right to control the use of the defendants' land. And there are no express provisions in the defendants' deeds which subject their land to a servitude or easement in favor of the plaintiff's land. The plaintiff can maintain his suit only upon the ground that the restrictions in the defendants' deeds create a servitude or right in the nature of an easement in their land, which, by implication, is annexed and made appurtenant to the plaintiff's land.

It often happens that owners of land adopt a general scheme or plan for its improvement, dividing it into house lots, and insert in the deeds of the several lots uniform restrictions as to the purposes for which the land may be used, such restrictions upon each being intended for the benefit of the other lots. In such cases it is held that the owner of each lot has, as appurtenant to his lot, a right in the nature of an easement upon the other lots, which he may enforce in equity if the owners of the other lots violate the restrictions. *Whitney v. Union Railway*, 11 Gray, 359. *Parker v. Nightingale*, 6 Allen, 341. *Linzee v. Mixer*, 101 Mass. 512. *Peck v. Conway*, 119 Mass. 546. *Tobey v. Moore*, 130 Mass. 448.

The rule is stated in *Whitney v. Union Railway* to be, that, when "it appears by a fair interpretation of the words of a grant that it was the intent of the parties to create or reserve a right, in the nature of a servitude or easement, in the property granted, for the benefit of other land owned by the grantor, and originally forming with the land conveyed one parcel, such right will be deemed appurtenant to the land of the grantor and binding on that conveyed to the grantee, and the right and burden thus created will respectively pass to and be binding on all subsequent grantees of the respective lots of land." But it is always a question of the intention of the parties; and, in order to make this rule applicable, it must appear from the terms of the grant, or from the situation and surrounding circumstances, that it was the intention of the grantor in inserting the restriction to create a servitude or right which should enure to the benefit of the

plaintiff's land, and should be annexed to it as an appurtenance. *Badger v. Boardman*, 16 Gray, 559. *Jewell v. Lee*, 14 Allen, 145. *Sharp v. Ropes*, 110 Mass. 381.

We are of opinion that the plaintiff has not sustained this burden. The Commonwealth was the owner of a large and very valuable tract of land on the Back Bay. It prepared a plan of the tract showing the contemplated improvements, and adopted a general form of deed to be given to purchasers. But there was not uniformity in the deeds actually given. It assumed and exercised the right of changing the conditions and restrictions in the deeds to different purchasers. In many deeds of lots on Commonwealth Avenue, it had, before the deeds under which the parties claim were given, inserted a form of restriction which permitted the purchasers to erect private stables.*

But it further appears in this case, that most of the lots of the Commonwealth's Back Bay land, including the lots owned by the parties to this suit, were sold by the Commonwealth by public auction at different times, and that, prior to such auction sales, a catalogue describing said lots was published, containing a plan of the lands and a form of the deeds which were to be given to the purchasers. This catalogue contained a note stating that "it is understood that the Commonwealth will not enforce the stipulation and agreement of the deed, that buildings erected upon the Back Bay" shall not in any event be used as a stable, "in such a manner as to prevent the erection and use of private stables by purchasers as appurtenances to their residences, provided such stables are so constructed and used as not to be justly offensive to the occupants of the surrounding buildings." This note was not inserted in the deeds given, but it is very significant as indicating what was the intention of the grantor in inserting the restriction as to building stables in the deeds which were given. It is inconsistent with the idea that the Commonwealth intended by this restriction to annex to neighboring lots the right to prevent the erection and use of private stables. It could not itself, in equity, restrain a purchaser, who had bought upon the faith of this note, from erecting and using a private stable in such a manner as not to be justly offensive to neighboring owners, and it could not have intended to give to such neighboring owners a greater right than it had itself.

The plaintiff contends that, as he had no actual or constructive notice of this catalogue and note, he is not to be affected by them. If this note was to be used to limit or impair an express grant to

* It appeared, from the agreed facts, that this permission was given in the deeds of twenty-one lots, all lying between Arlington Street and Berkeley Street, the nearest one of which to the defendants' lot was about nine hundred feet distant.

the plaintiff, this would be true. But, having no express grant, the burden is on him to prove, by the terms of the defendants' deeds, and by the surrounding circumstances, that an implied grant to him was intended by the grantor. When he took his deed, he was bound at his peril to ascertain what those circumstances and surrounding facts were. The note was a public declaration by the Commonwealth, intended to notify all purchasers of the scheme and purposes of the grantor. The plaintiff was bound to take notice of it, and his ignorance of it cannot enlarge his rights, and impose upon the defendants a burdensome servitude which it was not the intention of the grantor to impose.

Taking all the facts of the case at bar into consideration, a majority of the court are of opinion that the plaintiff has failed to show any right to restrain the defendants from using, in a proper manner, as a private stable, the building upon their lot.

Bill dismissed.

In this case, both of the parties had derived their titles from the Commonwealth under deeds given to purchasers at *auction sales*, and stress is laid in the opinion on the note relating to stables, which was inserted in the catalogues used at these sales. The case may probably be considered as decisive against the right in equity to restrain the proper use of buildings as private stables, as between all parties holding or deriving titles under auction deeds, since no facts appear in this case to distinguish it materially from the cases of all parties whose titles have that origin. Limiting the decision to the facts of the case, it may be said to leave undecided the rights of parties under deeds given to purchasers without notice at *private sale*.

Passage-ways on the Back Bay.

Passage-ways, so called in the deeds, running the whole length of the Back Bay from east to west, midway between and parallel with the avenues and streets, were made an essential feature of the general plan. All of the Back Bay lots, under this plan, abut in the rear upon a passage-way.

A stipulation in the deeds, stated in full on a preceding page,* requires the passage-way “to be *kept open* and maintained by the abutters in common.” The rule for the erection of buildings, based upon this stipulation, was thus stated in the Report for 1883: —

No part of the building can project into or over this passage-way. The passage-way must be kept open its full width from the ground up to the sky.

An interesting case, turning upon the meaning and effect of this stipulation, has been recently determined by the supreme judicial court.

In April, 1884, the Board was advised that a building, now known as the Hotel Kensington, was in process of erection at the corner of Boylston and Exeter streets on the Back Bay, from which bay-windows were about to be projected over the passage-way in the rear of the premises; and the Board was asked to interpose to prevent the projection of the windows. This request was made in good faith by a person owning an estate and residing on the passage-way.

The building was at this time advanced only to the height where the bay-windows began to project. The following letter was immediately sent to the proprietor of the building: —

COMMONWEALTH OF MASSACHUSETTS.

HARBOR AND LAND COMMISSIONERS' OFFICE,

Boston, April 21, 1884.

HENRY BIGELOW WILLIAMS, Esq.:

DEAR SIR, — We are advised, and complaint is made to us, that you are about to construct a building at the corner of Boylston and Exeter streets on the Back Bay, in violation of the restrictions in the deed or deeds, or bonds for deeds, by which the premises were granted by the commonwealth; and, in particular, that portions of said building are to

* See clause 5 of Restrictions, *ante*, page 11.

project into or over the passage-way, sixteen feet wide, in rear of the premises.

We take the liberty to send you by same mail a copy of our last annual report, calling attention to pages 5 to 22, inclusive, and especially to page 10, as a part of this communication.

We give you notice in behalf of the commonwealth, and of other grantees of Back Bay lots, that objection is made to your building in the manner above described, and that we shall insist upon your complying in all respects with the stipulations and restrictions in the commonwealth's deeds or bonds for deeds.

Very truly yours, for the commissioners,

JOHN E. SANFORD,

Chairman.

Several interviews with him followed, at which he urged his right to project the bay-windows, against the opinion and advice of the Board to the contrary, and requested that, in any legal proceedings which should be instituted, an injunction should not be asked to prevent his going on with the windows, because it would be easier for him to remove them after the building was finished, than it would be to put them on, if it should then be decided that he had a right to build and maintain them as proposed.

This request was acceded to, and it was accordingly arranged and agreed, that he should be allowed to go on with the bay-windows at his own risk; that proceedings should be instituted in the supreme judicial court to determine his right to project them as proposed, pending which an injunction should not be sought against him; that both parties should abide the decision of the court; and that, if the decision of the court was against him, he would remove the bay-windows.

The facts were then laid before the Attorney General for his advice, who, on the 19th day of May, 1884, filed the following Information in Equity:—

To the Honorable the Justices of the Supreme Judicial Court sitting in Equity within and for the County of Suffolk:

Informing, shows unto your honors Edgar J. Sherman, Esquire, attorney general of the commonwealth, on behalf of said commonwealth, and at the relation of John E. Sanford, Henry L. Whiting and John I. Baker, the harbor and land commissioners of the said

commonwealth, and brings this information against Henry Bigelow Williams, of Boston in our County of Suffolk :

That the commonwealth, acting by said harbor and land commissioners, has executed and delivered to said Henry Bigelow Williams, Francis A. Brooks and Charles B. Brooks certain bonds, copies whereof are hereto annexed, whereby, in consideration of certain sums of money paid and to be paid, said commonwealth agrees to convey to the said Henry Bigelow Williams, Francis A. Brooks and Charles B. Brooks certain parcels of land situated on the Back Bay district in the city of Boston, together forming a tract of land situated on the corner of Boylston and Exeter streets in said city, bounded south by said Boylston Street one hundred and sixty feet, west by said Exeter Street one hundred and twelve feet, east by other land of the commonwealth one hundred and twelve feet, and north by a passage-way sixteen feet wide one hundred and sixty feet, together with the part of said passage-way which lies southerly of its centre line and between the easterly and westerly lines of the tract aforesaid extended.

That, upon the full performance of the payments and conditions of said bonds, the said Henry Bigelow Williams, Francis A. Brooks and Charles B. Brooks, or their respective assigns, are entitled to deeds of the several lots making up the aforesaid tract, all of which deeds are to contain the same stipulations and agreements which are fully set forth in the said bonds.

That among said stipulations and agreements is the following, viz., "that a passage-way sixteen feet wide is to be laid out in the rear of said premises, the same to be filled in by the commonwealth, and to be kept open and maintained by the abutters in common, subject only to the reserved right of making and maintaining a common sewer through the same, for the purpose of draining the lands and streets which may be conveniently drained thereby."

That the said Francis A. Brooks and Charles B. Brooks afterwards transferred and assigned to the said Williams the bonds held by them respectively, and all their rights under the same, thereby giving the said Williams the benefits, and subjecting him to the burdens and restrictions, of the said bonds in every respect.

And your orator on the information aforesaid alleges, on his information and belief, that the said Williams is building on the tract of land aforesaid, with bays or projections into and over said passage-way, contrary to the stipulations of the said bonds.

To the end, therefore, that the said Henry Bigelow Williams may be restrained during the pendency of this suit from building into or over said passage-way, and for such other and further relief as

to your honors shall seem meet and as the nature of the case shall require :

May it please your honors to grant unto your orator not only a writ of injunction directed to the said Henry Bigelow Williams, forbidding him to build as aforesaid during the pendency of said suit, and forbidding the said Henry Bigelow Williams, his agents, attorneys and assigns, to erect any building on said lots of land projecting into or over said passage-way, or to do any other act inconsistent with the covenants and agreements entered into as aforementioned ; but also a writ of subpœna, issuing out of and under the seal of this honorable court, directed to the said Henry Bigelow Williams, commanding him, under a certain penalty therein named, to be and appear personally before your honors on a certain day therein named, and then and there full, true, direct and perfect answers to make to all and singular the premises (but not under oath, the benefit of which is hereby waived) ; and further, to stand to, perform and abide such further order and decree in the premises as to your honors shall seem meet.

EDGAR J. SHERMAN,

Attorney General of the Commonwealth.

JOHN E. SANFORD,

HENRY L. WHITING,

Harbor and Land Commissioners.

The bonds for deeds referred to in the information are in the usual form, and set forth the same stipulations or restrictions as have been given on pages 10 and 11 of this Report ; and the copy of one of these bonds annexed to the information, is here omitted.

On the 3d day of June, 1884, the following Answer to the information was filed by the respondent : —

And now comes the respondent Williams, and for answer to the information aforesaid says :

He admits that he holds the bonds of the Commonwealth of Massachusetts for the conveyance to him of the parcels of land described in said information, a copy of one of which bonds is annexed to the information, and that the other bonds, originally given to F. A. Brooks and Charles B. Brooks respectively, but now owned by him, are of the same tenor as the copy annexed and referred to ; and he admits that he is now erecting upon the said parcels of land an apartment house ; but he denies that he is erecting the said building “ with bays or projections extending into and

over the passage-way" (referred to in said information) "contrary to the stipulations" or provisions in the said bonds contained.

This respondent further answering says, that long before the date of the said bonds, or any of them, the commonwealth had laid out, filled in and built the passage-way referred to in said bonds as to be built by it, and had placed a common sewer under the same, as was agreed should be done.

And this respondent shows, that the said passage-way as filled in by the said commonwealth at and before the time of its sale of the said premises to him, had a width on its surface of much less than sixteen feet, viz., of about eight feet, along the middle or centre line of said passage-way, one half of which only stood upon or over that part of the passage-way bargained to this respondent and adjoining the lot on which he is now building.

This respondent also shows, that by the said bonds he became and now is entitled (upon full payment of the sums provided by said bonds to be paid by him) to a conveyance in fee of all that part of said passage-way (sixteen feet in width) that lies southerly of its centre line, as shown by the plans referred to in said bonds; meaning a strip of land eight feet in width and one hundred and sixty feet in length, measuring easterly from Exeter Street, subject, however, to the easement of a passage-way of a width of sixteen feet in all, and to the location and maintenance of the common sewer therein, as provided in said bonds.

And the said Williams further answering admits that, in the construction of his said building upon said premises, he has placed bay-windows in each story of his building above the basement, extending into the space over the southerly portion of said passage-way for a distance not exceeding three feet on the first floor, and not exceeding four feet on the upper floors; but he says that none of these projections are within a distance of eight feet from the surface of the passage-way as laid out and filled in by said commonwealth; and he likewise says, that the southerly line of roadway, as filled in by the commonwealth as and for a passage-way to the rear of any buildings to be erected by this respondent on said premises, did not come nearer than four feet to the rear line of said lot to be used for buildings, so that none of the bays or projections of this respondent's building as erected now extend or project over any part of the passage or roadway as constructed by the commonwealth itself, in pursuance of the provisions in its said bonds or contracts (with this respondent) contained.

And this respondent avers that he is, and for many years has been, familiar with the construction by others of buildings upon the Back Bay lands sold by the commonwealth for improvement by

deeds of the form set forth in the bonds attached to this information, and that he has himself in times past built or superintended many such buildings, and has had occasion to confer with the persons holding the office of land commissioners of the state, in charge of such land; that during all that time he has understood that the "passage-way" lots, so laid out by the commonwealth, were intended for the passage of persons on foot, and of wheeled vehicles propelled by horses, &c., upon or over the surface of such passage-ways; and that until lately, and since the purchase by him of the land in question, he has never known or heard of any other construction of the word "passage-way" as used in the deeds of the said commonwealth of its Back Bay lands.

And this respondent further answering says, that it is, and long has been, the custom of those owning the sixteen-foot passage-ways to the centre line thereof, to devote a strip thereof about eight feet in width along the middle or centre to the passage of wheeled vehicles, and to devote the space (not required for vehicles) on either side to passers on foot, and to lay sidewalks of brick for that purpose three or four feet in width; and that it is his intention so to improve his own portion of the said passage-way in this case, with the consent of abutting owners; and he says that, as thus improved, no persons or vehicles heretofore known and used in the city of Boston to connect with the rear of dwellings or other buildings, would or could be obstructed in moving along and over the surface of said passage-way by reason of the bay-windows or other projections from his building referred to in the said information.

And this respondent further answering shows that, under the laws regulating buildings in the city of Boston, he is required to provide suitable fire escapes upon the building now being erected by him on said premises; that the rear of said building abutting on said passage-way is the only suitable place for such fire escapes, and that he is intending to place such fire escapes alongside the bays or windows overhanging said passage-way, so that they may be accessible from said windows, and will do so unless prevented by the order of this honorable court; and that, if so prevented, it will be impossible for him to comply with the laws relating to fire escapes without destroying and removing a portion of the brick walls of his said building, unless he is permitted to hang or suspend such fire escapes over a small portion of the space which, on the surface of the ground, makes part of the sixteen-foot passage-way above mentioned.

HENRY BIGELOW WILLIAMS.

F. A. BROOKS,
Solicitor.

Issue was joined on the information and answer, and the case was heard at the June term, 1884, by Mr. Justice Devens, who reserved it for the consideration of the full court upon the pleadings, and upon the following Report by him of the facts and evidence:—

This information seeks to restrain the defendant from erecting or maintaining on certain lots of land situate at the corner of Boylston and Exeter streets on the Back Bay in the city of Boston, a building with bay-windows or projections extending into or over the passage-way laid out in the rear of said lots; and the case is reserved, upon the pleadings, facts and evidence as here reported, for the consideration of the full court, for such order or decree as may be required.

It appeared in evidence, and I find as a fact, that the commonwealth, acting by said harbor and land commissioners, executed and delivered to said Henry Bigelow Williams, Francis A. Brooks and Charles B. Brooks certain bonds, a true copy of one of which is annexed to the bill, and it is agreed that the other bonds are similar. It was also agreed that the bonds to Francis A. Brooks and Charles B. Brooks had been assigned by them to said Henry Bigelow Williams, and that this case might be heard and decided as if said defendant held a deed from the commonwealth of said lots of land in place of said bonds for a deed, such deed to contain all the provisions, agreements, conditions and stipulations set forth in said bonds.

I find also as facts, that the defendant is erecting a building upon said lots, intended for use as a hotel or apartment house, with bay-windows projecting from the rear wall of said building, and extending a distance of from three to four feet into or over said passage-way; that the lowest parts of said bay windows are about eight feet above the grade of said passage-way, and that said bay-windows are intended to be carried upward to the roof of said building, which is to be six stories high above its cellar or basement; that, immediately upon receiving notice of the intention of the defendant to project said bay-windows into or over said passage-way, and within a few days after said defendant had begun so to project the lowest parts thereof, said harbor and land commissioners, in behalf the commonwealth, on April 21, 1884, wrote to said defendant the letter of that date, a copy of which is hereto annexed; * that said passage-way is laid out sixteen feet wide across the whole extent of the Back Bay, midway between Boyls-

* See copy of Letter, *ante*, page 21.

ton and Newbury streets and parallel thereto; and that the sum of \$11,200, stipulated to be paid to the commonwealth in the bond for a deed, a copy of which is annexed to the bill, was computed for the area of the lot described in the bond, not including any part of the area of said passage-way; and that the other bonds aforesaid are similar in this respect.

The defendant offered to show, and I find as facts, if such evidence be competent, that, prior to the date of said bonds, the commonwealth had laid out and filled in said passage-way up to grade and sixteen feet wide, and had built a common sewer under the same; that, after the filling of said passage-way by the commonwealth, the sides being unprotected by walls, the earth sloped off from the top towards the bottom at the sides, so that there was on the surface thereof only a width of about eight feet along the middle or centre line thereof remaining up to grade; that, on the portion of said passage-way nearest to Dartmouth Street, a strip thereof about eight feet in width along the middle or centre line thereof has been devoted by the abutters to the passage of wheeled vehicles, and the space of about four feet on each side to passers on foot, and that sidewalks of brick three to four feet wide have been laid by the abutters on said passage-way near Dartmouth Street, and are usually so laid by the abutters on other passage-ways on the Back Bay, for the convenience of foot passengers; that it is the intention of the defendant to so lay out the portion of the passage-way in the rear of his said lots, that is, so as to have a roadway in the middle and sidewalks on each side thereof; and that, as thus laid out, persons on foot would not be obstructed ordinarily, by reason of said bay-windows, in passing along and over the surface of said passage-way; and that ordinary vehicles heretofore used in the city of Boston would not be so obstructed in case they should keep within the limits of the strip of about eight feet in width along the middle or centre line of said passage-way described as aforesaid; that the defendant has been notified by the city of Boston, and is bound by law, to provide suitable fire escapes upon his said building; that the rear of said building is the most suitable place for such fire escapes or ladders, and that he is intending to place ladders alongside said bay-windows overhanging said passage-way, so that the ladders may be accessible from the windows, and that the windows and ladders together may constitute a fire escape.

It also appeared in evidence, if competent, that all the deeds of lands of the commonwealth fronting on Boylston and Newbury streets, contain restrictions to prevent the erection or use of buildings thereon for stables, or for mechanical or manufacturing pur-

poses ; that the passage-way laid out as aforesaid was intended and is adapted to form a means of access to and from the rear of dwellings and other buildings erected on said streets, respectively ; and that the bay-windows or projections in question would not obstruct the passage along the surface of said passage-way, near the centre line thereof, of the vehicles ordinarily employed in carrying supplies to or from dwellings, or in removing dirt or garbage.

CHAS. DEVENS, J. S. J. C.

The cause was argued before the supreme judicial court, sitting as a full court for the Commonwealth, at the January term, 1885, by *Harvey N. Shepard*, Assistant Attorney General, for the Commonwealth, and by *Hon. E. R. Hoar* and *Francis A. Brooks, Esquire*, for the respondent, upon the following Briefs :—

BRIEF FOR THE COMMONWEALTH.

I.

It is immaterial that, after the filling of the passage-way, the earth sloped off from the top so that the surface remained only about eight feet wide, since the agreement is for a passage-way sixteen feet wide, which agreement cannot be thus narrowed or restricted. *Tucker v. Howard*, 122 Mass. 529. *Nash v. N. E. Mut. Ins. Co.*, 127 Mass. 91.

It is also immaterial that other abutters had adapted a portion of the passage-way to the use of vehicles, and the remainder to the use of pedestrians, and that the respondent intended to do the same. That the rear of the building is a suitable place for fire escapes or ladders does not justify the projection of bay-windows over the passage-way.

II.

The material question in this cause is, whether the agreement provides for a right of way merely, to be kept open so far as not to encumber the passage of pedestrians and vehicles upon the surface, or has a broader construction, so as to provide also for light, air, prospect, and every other accommodation and advantage which an open court furnishes to abutters. In this connection it was competent to show that the lands adjoining these premises also are under “restrictions to prevent the erection or use of buildings thereon for stables or for mechanical or manufacturing purposes ;” that the respondent paid nothing to the Commonwealth for the area

of the passage-way ; and that it is in fact part of a street, sixteen feet wide, across the Back Bay ; since these things, in the language of the court in *Salisbury v. Andrews*, 128 Mass. 336, “ show the sense in which particular words were probably used.” Therefore this “ is not the case of a mere right of way where the owner of the soil may do any acts which do not interfere with the enjoyment of the easement ; but it is a right to have the entire court or passage-way kept open to the sky.” *Codman v. Evans*, 5 Allen, 308. *Schworer v. Boylston Market Association*, 99 Mass. 286. *Linzee v. Mixer*, 101 Mass. 512. *Salisbury v. Andrews*, 128 Mass. 336. Compare *Underwood v. Carney*, 1 Cush. 285. *O’Linda v. Lothrop*, 21 Pick. 292.

BRIEF FOR RESPONDENT.

FACTS.

The respondent became the purchaser from the State of certain building lots, situated on the Back Bay (so called) in Boston, and held bonds of the State for the conveyance of the said lots upon the payment in full of the purchase money ; but, by agreement, the case is to be heard and decided as if the respondent had already become the grantee of said lots by a deed from the State containing the same provisions and stipulations which are set forth in the bonds for such deeds.

The premises so bonded or granted to respondent are described as fronting on Boylston Street, and extending back northerly therefrom one hundred and twelve feet “ to a passage-way sixteen feet wide,” and they embrace so much of the area of the said sixteen-foot passage-way as lies southerly of a line drawn through the centre or middle of the same from west to east ; that is to say, the granted premises consist of the land lying within one hundred and twelve feet of Boylston Street, and also of a strip of land eight feet in width next adjoining the same on the north, which latter strip makes the southerly half of the sixteen-foot common passage-way above mentioned, the fee of said passage-way on either side to its middle being owned by the respective abutters thereon, subject to the easement or other rights whatsoever provided for in said deeds. The bonds or deeds contain this clause : “ *That a passage-way sixteen feet wide is to be laid out in the rear of the premises, the same to be filled in by the Commonwealth, and to be kept open and maintained by the abutters in common.*”

This passage-way had been laid out and filled in before the sale to respondent, so as to form a roadway for vehicles in the middle,

eight feet in width, leaving a space or width of four feet on each side to be utilized for sidewalks or passers on foot.

The respondent was proceeding to erect a large apartment house upon his said lots, the rear walls of which were set a hundred and twelve feet from Boylston Street; that is, along the southerly line of the sixteen-foot passage-way. From the second story of this building, bay-windows were built out or projected over the passage-way, the lower parts of which are eight feet above the surface of the passage-way, and extend three or four feet over that portion of it set apart for sidewalks or passers on foot. Thereupon the relators in this case addressed to the respondent the letter, a copy of which is annexed [see page 21], in which they refer him to their last annual report (1883), and especially to page 10 thereof, "as a part of this (their) communication."

The portion of the report thus incorporated into their letter is in these words: "A passage-way, in rear of the premises, * * * must be kept open and maintained by the abutters in common. No part of the building can project into or over this passage-way. The passage-way must be kept open its full width from the ground up to the sky. See *Schwoerer v. Boylston Market Association*, 99 Mass. 285."

The bill in this case was brought to enjoin the erection of these bay-windows, and came to a final hearing before Mr. Justice Devens, who declined * to grant an injunction, and reserved the case for determination by the full Court.

LAW.

I.

As the relators in this case, in their communication to the respondent, planted themselves on the case of *Schwoerer v. Boylston Market Association*, as their authority for interfering, we submit, in the first place, that their bill or information is not supported by that citation. The two cases are unlike in several material respects. The case at bar is that of a common passage-way laid out by the former owner (Commonwealth) in a particular way, and then conveyed in fee, subject to the provision that it is to be "kept open and maintained" by the abutters in common; and the main question is, what is required of the abutters or grantees of the passage-way premises in this respect?

It appeared in evidence that the passage-way so laid out "was intended * * * to form a means of access to and from the rear

* This statement is not accurate. Judge Devens was not asked to grant an injunction. As agreed by the Board with the respondent, the Assistant Attorney General stated distinctly to the Court that an injunction pending the suit was not desired.

of dwellings * * * erected on said street" (Boylston Street); "that the bay-windows (in question) would not obstruct the passage along the surface of said passage-way (near the centre line thereof) of the vehicles ordinarily employed in conveying supplies to or from dwellings, or in removing dirt or garbage"; also, "that persons on foot" (unless more than eight feet in height) "would not be obstructed ordinarily by reason of said bay-windows in passing along and over the surface of said passage-way" (under the windows), and "that ordinary vehicles heretofore used in the city of Boston would not be so obstructed in case they should keep within the limits of the strip of about eight feet in width along the middle * * * of said passage-way" (eight feet being the entire width of the surface of the passage-way as laid out and filled in by the State, and as sold to respondent).

We therefore submit that the words "kept open," in this conveyance, mean, kept open as and for a passage-way as laid out and filled in by the State itself. These words do not even require that sidewalks be laid to accommodate passers on foot outside of the eight-foot roadway made by the State; and the passage way here provided for is along the surface of the ground, and not in that part of the sky above the reach of mortals when on foot or in wheeled vehicles drawn by horses.

The case cited from 99 Mass. 285, was one providing for light and air as well as a passage-way. The language of the conveyance in that case was, that the land "shall not be subject to have any fence or building erected thereon" (p. 292, bottom). The defendants in that case took the ground that the plaintiff's deed provided for a passage-way only. The Court held that the deed provided not only for a passage-way, "but also for light, air and prospect." The Court there said: "It is not the case of a mere right of way, where the owner of the soil may do any acts which do not interfere with the enjoyment of the easement" (See p. 292, bottom, and p. 293, top). Again, in the case 99 Mass. 285, the easement of light and air was claimed by the owner of a building located on a narrow court or passage-way across which the defendant was erecting a building extending over the whole width of the court or passage-way, thus entirely excluding light and air from a portion of the passage-way on which the plaintiff's building fronted. We therefore submit that this case wholly fails to sustain the contention of the relators, or the position taken by them in their letter to the respondent.

There is, however, another case which may be cited by them, that of *Salisbury v. Andrews*, reported in 128 Mass. 336. That was another case where buildings fronted upon a court or passage-

way, and the deed was held by the Court to require the way to remain open to the sky and unobstructed; not for the purposes of a passage or road way only, but because the language employed, taken in connection with the facts, indicated the intention of the parties to secure the benefits of an open court, as affording them light and air, and not merely right of way. The language of the deed there was, that the way "shall be left and always lie open for the passage-way or court aforesaid, for the common use and benefit of both of said parties and their said respective estates."

It thus appears that, wherever it has been held necessary that passage-ways or courts should remain entirely open overhead, this ruling has been put upon the ground that the language of the deeds contemplated an open area for securing light and air, and not at all as an incident to the right of way. In this case, no other object seems to have been in view except the securing of a rear passage-way.

Again, it being found by the reserved case that the respondent is to be treated as the grantee from the State of the land in question, the respondent is presumed to have become the owner of the soil or of a fee therein, subject to the easement of the passage-way charged thereon by the deed, and the right to build a sewer under the passage-way.

In *Atkins v. Bordman*, 2 Met. 467, this Court took occasion to define exactly an easement which consists of a right of way. It did so in these words: "If the easement is a right of way, this consists in a right to use the surface of the soil for the purpose of passing and repassing, and the incidental right of properly fitting the surface for that use; but the owner of the soil has all the rights and benefits of ownership consistent with such easement. '*Cujus est solum, ejus est usque ad cælum.*' If any other person has an easement in it, the owner has still all the beneficial use which he can have consistently with the other's enjoyment of that easement." The case of *Welch v. Wilcox*, 101 Mass. 164, is to the same effect. The Court there said, "The plaintiff, as owner of the soil, has a right to all the reasonable and beneficial use of the way which he can make consistently with the enjoyment of the easement"; i. e., by others entitled to such easement.

II.

When the Commonwealth parted with the title to this passage-way, or the land under the same, to the respondent (as is assumed to have been done) for the use and benefit of the abutters in common, and reserved the right to enforce the several stipulations

of the deed by entry on the premises for that purpose through its agents, we submit that it could only proceed either by executing the power of entry, etc., reserved in the deed, or else by action at law for a breach of the stipulations, or some of them, by the respondent. Only these two remedies are available to the Commonwealth under the supposititious deed to respondent.

The Commonwealth cannot have the assistance of a Court of Equity for the execution of its right of entry to remove the bays, because the deed does not require this entry to be made, but leaves it to the discretion of the State authorities to exercise or not to exercise the power. Story's Eq. Juris. § 170.

There would be no jurisdiction in equity on which the Commonwealth, as complainant, can have a decree for the removal of these bay-windows under the right of entry reserved for that purpose, even if such entry and removal were made mandatory in terms. It will not, probably, be claimed that any such general jurisdiction in equity in favor of the Commonwealth exists, unless upon the ground of preventing a breach of the respondent's agreement, or in aid of the specific performance of such agreement as contained in the stipulation about the passage-way.

But if the plaintiff's case were put upon either of these grounds, we should reply : —

Firstly, that the agreement or covenant of the respondent in regard to this passage-way is an implied one, he being only a grantee under a deed poll from the State; and we believe implied agreements are not specially enforced in equity.

Secondly, that the State, after parting with the title to this land, has no longer any pecuniary interest to be protected by the extraordinary remedies of equitable jurisdiction.

It may be said that this difficulty has been cured by Sect. 5 of Chap. 19 of the Public Statutes. On the contrary, we submit that special equity jurisdiction is there conferred only in favor of grantees who hold lands under deeds of the State containing the same provisions as respondent's deed.

The case of *Linzee v. Mixer*, 101 Mass. 512, was a suit by one grantee of the State against another, brought under this statute; and wherever special statute provisions are relied on as conferring jurisdiction, these provisions must be strictly followed, and the suit must be in the name of some grantee of land from the State.

The case of *Attorney General v. Gardiner*, 117 Mass. 492, is not opposed to this view. That case was not to enforce a mere private right of way or easement in premises granted by the State, but to enforce restrictions imposed against building on the front part of the lots bounding on the highway for the benefit of the

public; hence, in that suit, the State represented the interests of the public generally, and not merely the interests of a few private owners of the adjacent property, as in the present case it claims to do. It does not appear that the special statute of 1866 (Public Statutes, c. 19, § 5) was relied on to support the jurisdiction of the Court in that case, no allusion having been made to that statute by either party or by the Court.

On the 23d day of June, 1885, the full court sent down a Rescript, ordering the following entry to be made in the case, with the appended brief statement of the grounds of decision by Mr. Justice Charles Allen:—

Decree for Plaintiff.

An information for enforcing the stipulation may be maintained by the attorney general.

By the true construction of the stipulation, the passage-way is to be kept open for the full width of sixteen feet to the sky, for air, light and prospect, and other uses.

The extended Opinion of the Court was also given by Mr. Justice Charles Allen, as follows:—

The first question which we have considered is, whether an information in the name of the attorney general can be maintained to enforce the stipulations in respect to the passage-way. In *Attorney General v. Gardiner*, 117 Mass. 492, it is declared that the Commonwealth, in devising the scheme of improvement of the Back Bay lands, acted in a two-fold capacity,—as the proprietor of lands which it held and might sell, and as the sovereign power, authorized to lay out highways for the benefit of the public; and that, in the latter capacity, it might enforce these provisions and restrictions, against all persons bound by them, by an information in equity in the name of the attorney general. It is suggested that there is a distinction between that case and the present in this particular, that there the information was brought to enforce restrictions imposed against building on the front part of the lots bounding on the highway, for the benefit of the public; while here it is brought only in the interest of a few private owners of the adjacent property bounding on the passage-way. But the Commonwealth properly reserved to itself the right to enter upon the premises by its agents, and, at the expense of the party in fault, to remove or alter, in conformity with the stipulations, any building or portion thereof which might be erected on the premises in a

manner or to a use contrary to the stipulations. Also, by Pub. Sts. c. 19, § 5, in all cases where the Commonwealth has such right, all grantees under the deeds by which such right is reserved, and their legal representatives and assigns, may, by proceeding in equity, compel the board of harbor and land commissioners to so enter and remove or alter such building or portion thereof. It does not in this case appear affirmatively that the Commonwealth has sold all of its land in the neighborhood of the premises in question, and that it has no direct pecuniary interest in enforcing the stipulations. But, assuming the fact to be so, it still has a duty to perform in this respect. Moreover, it may be said to have constituted itself a trustee for all the parties in interest, by the form of the stipulation, with the implied assent of each grantee who takes a deed containing it. In either aspect, it has such an interest and duty as to entitle it, by its proper officer, to sue in this court, on behalf of the rights and interests of those who claim its protection.

The principal ground of objection to the maintenance of the information is, that the defendant has not infringed upon the stipulation referred to.

Before considering this question in the light of the particular stipulation, it may be well to review some of the principal authorities cited at the argument. The leading case upon this subject is *Atkins v. Bordman*, 2 Met. 457, where it was held that the owner of land, over which his grantor had reserved a passage-way, might, under the peculiar circumstances of that case, lawfully cover such passage-way with a building, if he left a space so wide, high and light that the way was substantially as convenient as before, for the purposes for which it was reserved. There, from the language of the reservation, construed in the light of the existing facts and circumstances, the right reserved was held to be that of "a suitable and convenient footway to and from the grantor's dwelling-house, of suitable height and dimensions to carry in and out furniture, provisions and necessities for family use, and to use for that purpose wheelbarrows, hand-sleds, and such small vehicles as are commonly used for that purpose, in passing to and from the street to the dwelling in the rear, through a foot passage, in a closely built and thickly settled town." It was a use which was individual to the occupant of that house, and not for the public. It was limited to certain simple uses, connected with getting things into and out of the house. It is obvious that the rights of the single person entitled under such circumstances to a passage-way, are not necessarily identical with the rights involved in the present case.

In *Schwoerer v. Boylston Market Association*, 99 Mass. 285, the provision in the deed establishing the passage-way declared that it should “not be subject to have any fence or building erected thereon;” and this was held to give a right to have the entire court or passage-way kept open to the sky, for light, air and prospect, and every other accommodation and advantage which such an open court might furnish to an estate abutting upon it. In *Brooks v. Reynolds*, 106 Mass. 31, the passage-way was declared in the deed to be for light and air, and was always to be kept open for the purpose aforesaid; and this was held to give a right to the open and unobstructed passage of light and air from the ground upwards, and throughout the length of the passage-way.

The case of *Salisbury v. Andrews*, 128 Mass. 345, is more like the present case. These tenants in common had laid out their land in Boston with a passage-way or court, upon both sides of which they had erected buildings fronting upon the way, and, by a deed of partition of the property, they provided that the way “shall be left and always lie open for the passage-way or court aforesaid, for the common use and benefit of both of said parties in their respective estates.” It was held that the right of an owner under this deed was not simply a right of way, but a right to the use and benefit of an open court, extending as well to the light and air above, as to actual travel upon the surface of the earth.

It is necessary now to look at the terms of the bond in which the stipulation relied on in the present case is contained, in order to see what it means.

In the first place, it is to be borne in mind that the place in question is a part of a great scheme of improvement of waste land in a city for streets and dwellings. The description of the land carefully defines the width and lines of the passage-way: “running one hundred and twelve feet to a passage-way sixteen feet wide; thence westerly on the line of said passage-way;” “also all that part of said passage-way sixteen feet wide that lies southerly of its centre line, and between the easterly and westerly lines of said premises extended; reference being had to the plan accompanying the fifth annual report of the commissioners on the Back Bay.” A reference to the plan shows a system of streets, covering an extensive territory, with passage-ways for the accommodation of houses on two streets, and for access to their rear entrances. “Any building erected on the premises shall be at least three stories high for the main part thereof, and shall not in any event be used for a stable, or for any mechanical or manufacturing purposes.” There were also other provisions showing that dwelling-

houses of a high class were contemplated. Afterwards followed the particular stipulation relied on, "that a passage-way sixteen feet wide is to be laid out in the rear of the premises, the same to be filled in by the Commonwealth, and to be kept open and maintained by the abutters in common."

It was contemplated that buildings might be erected on both sides of this passage-way. Each owner might build up to the line of it. The defendant has done so, and has built bay-windows from a point eight feet above the sidewalk, and extending from three to four feet into the passage-way, to the top of his house six stories high. If the opposite owner should do the same, the passage-way between the buildings, extending upwards from a point beginning eight feet above the surface of the ground, would be eight feet, instead of sixteen, in width. It would be half closed up, so far as light and air and prospect are concerned; and, if this may be done, it is difficult to place any practical limit to what might be done in this manner. The passage-way was designed as a thoroughfare for the accommodation of many persons. In appearance, it is on the plan indistinguishable from a narrow street. It is connected at each end with broad and important streets. [It was to be "kept open." No gates could be put at the ends of it. It was to be "maintained;" that is, in good order for use. Its width shows that it was designed for vehicles drawn by horses, as well as for travellers afoot. The supplies for all the houses on both sides of it, for its entire length, would be chiefly deliverable, and all refuse matter removable, by its means.

Thus we have a passage-way of defined dimensions, in the rear of all the houses on two broad streets, designed for use by all who may have occasion to seek the rear entrances to any of the houses on either street; a passage-way available also for police purposes, and for use in the extinguishment of fires; a passage-way which is to be maintained, and kept open, and designed for horses and wagons, in a part of a large city which is designed to be wholly occupied by dwellings of a high class, to which air and light and prospect are not only desirable but essential, in the rear as well as in the front, with no limitation to the use which may be made of it, or of the persons by whom it may be used.

In view of these considerations, we think the language of the stipulation was designed to signify a separation of sixteen feet at least between the rear portions of the buildings abutting on the passage-way. A passage-way sixteen feet wide was to be kept open, not merely at the ends, but open to the sky throughout its entire length, for the general convenience and benefit. It is easy

to see that the rights of others would be lessened, upon any other construction. The opposite owner, who might not wish in like manner to build into the passage-way, would have in the rear of his house a space just so much the narrower. The adjacent owner on the same side, who did not wish to occupy a part of the passage-way with his building, would have light, air and prospect cut off. The right to occupy the passage in this manner themselves, would be no equivalent to owners who did not wish to build their houses so as to extend back to the line of it.

There is nothing in the facts proved at the hearing and reported to us, which in any way controls the construction thus put upon the language of the stipulation. The result is, that a decree must be entered for the removal of the projections.

Decree accordingly.

Shortly after the filing of the rescript of June 23d, the respondent made application to the Board to allow him to delay the removal of the bay-windows until after the first of the next October; but the Board, in view of the circumstances and express understanding under which the suit was begun, and in the absence of any reasons of special urgency shown for such delay, did not think the respondent was entitled to unusual indulgence, or deem it its duty to interfere with the regular and ordinary course of procedure in the courts; and so informed the respondent. The same view was taken, it may be said here, when a more formal petition for indulgence and delay was presented to the Board several months later, upon which the respondent and his counsel were fully heard, — especially, as the grounds upon which the petition was then pressed, were at the same time being urged upon the court as grounds of legal or equitable defence, or as reasons for setting aside its decree.

Several weeks having elapsed since the decision of the court without any indications of compliance by the respondent, formal notice of the decision was given,* July 15, 1885, to his solicitor of record, Francis A. Brooks, Esquire, and, July 20th, to the respondent personally. No effect

* It will be understood that the management of the case in court, and all matters relating thereto, have been conducted by the Attorney General and his Assistant. This is not said to avoid any responsibility in the matter, for the conduct of the case has had in all respects the approval of the Board, with a full appreciation of the ability and fidelity with which it has been managed by the law officers of the Commonwealth.

appearing, notice of a motion to the court for a final decree was given, July 29th, to his solicitor, who, August 3d, withdrew from the case, and the same notice was that day given to the respondent.

The motion for a final decree was made to the court August 6th, but the hearing thereon was postponed at the request of the respondent, to enable him to procure the attendance of counsel; and he was notified the same day that the hearing would be had August 11th. On the following day, August 7th, the respondent filed a Suggestion of Change in Ownership, etc., as follows:—

And now the above-named defendant, Henry Bigelow Williams, upon being informed that application is made by the attorney general for a decree against him in the above-entitled suit, comes and makes known to the court that he is no longer the owner of the real estate described in the bill of complaint in said suit, but that the same has been conveyed to Robert Sturgis, of the city of New York in the State of New York, who is now the owner of said real estate. And said defendant respectfully suggests that no further proceedings should be had in said suit until the said Robert Sturgis, the owner of said estate and property, has been summoned in and made a party to said suit.

On the 11th of August, the hearing was begun, and further continued at the request of the respondent, — George S. Hale, Esquire, appearing as his counsel. After more than six weeks of postponements and delay, the respondent filed, September 23d, a Petition * for a rehearing, etc., which was disallowed by Mr. Justice Charles Allen, who, on the same day, entered a decree for the removal of the bay-windows, and filed the following Statement of the Case as it appeared before him at the hearing:—

This case came on for a hearing on the motion of the attorney general for the entry of a decree this day. The defendant presented an application in writing, setting forth reasons against the entry of a decree at this time, which is on file. I heard the parties and took the testimony of the defendant upon certain points.

It appeared that the defendant erected the bay-windows in controversy under the advice of legal counsel that his right to do so

* The petition is here omitted because of its length, and because the principal matters alleged therein appear in the statement of Mr. Justice Allen, which follows.

was clear ; that the owners of many of the lots abutting on the passage-way over which they project, have signed a paper assenting to the continuance of the bay-windows as they now are ; that the owners of certain others of the lots, or persons representing such owners, have promised, or expressed a willingness, to sign said paper, and the defendant believes all such owners will finally sign said paper except the city of Boston ; that the city owns three adjacent lots, one of which is opposite to a portion of the land on which the building erected by the defendant stands, and the officers of the city do not feel authorized to sign the assent ; that no notice under Pub. Sts. c. 126, § 13, was filed in the registry of deeds by the attorney general until August 11, 1885, when such a notice was filed ; that the premises were subject to a first mortgage of \$150,000 to F. A. Brooks, dated [April 21, 1885], who appeared as one of the counsel of the defendant at the hearing before the full court and theretofore ; that defendant executed a mortgage, dated May 4, 1885, to one Livingstone, of Lowell, to secure \$30,000, money lent by him to the defendant ; that defendant did not tell Livingstone of the pendency of this information, and defendant testified that he did not believe Livingstone knew of it, and there was no further testimony on the point of Livingstone's knowledge ; that the rescript was filed June 23, 1885 ; that on [July 7], 1885, defendant conveyed the premises to his mother, Mrs. [Ellen B.] Williams, in consideration of previous indebtedness to the amount of \$, and expected advances to be made by her thereafter to the amount of \$20,000 more, — there was no testimony as to whether she knew of the pendency of the information or not ; that she conveyed the premises without consideration to Robert Sturgis, of New York ; that there were in existence, in buildings on the Back Bay, several instances of similar projections where no steps had been taken to secure their removal, of which the defendant had knowledge when this information was filed and theretofore ; that, prior to the filing of this information, the defendant submitted to the inspector of fire-escapes for the city of Boston his proposed plan of building these bay-windows with fire-escapes by the sides thereof, and the said inspector approved of the same ; that said inspector gave a certificate, dated September 10, 1885, of various matters relating thereto, which was read before me, and the facts stated therein were not controverted ; that the defendant owns the adjacent lot on the east of the building, and has provided for its being kept open forever as an open space ; that provision has also been made for keeping open thirty feet in space on the north side of several of the adjacent lots on the same side of the passage-way ; and that defendant wishes to make application to the

general court for some legislation for his relief in the premises. The defendant also asked that in no event should any decree be entered against him personally, but that the decree, if any, should be executed by officers of the State, or the present owners of the property.

I considered that none of these matters furnished any good reasons for omitting or delaying to enter a decree, in conformity to the motion of the attorney general, requiring defendant to remove the bay-windows, and accordingly entered such decree, which is on file.

Defendant's counsel wished me to reserve the questions presented by him for the full court, but I declined to do so. Defendant's counsel wished me to make a statement of the facts as they appeared before me, intimating his intention to enter an appeal from my decision. I told him that I did not consider that there was any right of appeal, and that the decree covered nothing that had not been passed on by the full court; but, in compliance with his request, I make this statement of the case as it appeared before me, for whatever use either party may be entitled to make of it.

CHARLES ALLEN, *J. S. J. C.*

The Decree which was entered, as above stated, September 23d, was in these terms:—

This cause came on to be heard at this term, and was argued by counsel; and thereupon, upon consideration thereof, it is ordered, adjudged and decreed, that the respondent remove, within thirty days, at his own expense, the bays or projections into and over the sixteen-foot passage-way laid out in the rear of a certain parcel of land [here follows the description]: being the bays or projections into and over said passage-way from a building on said parcel of land, and the same premises referred to and described in the information in this suit. Also, that the respondent pay the costs in said suit.

A copy of this decree was served on the respondent September 24th, who, October 1st, entered a claim of Appeal therefrom; and, October 10th, filed the following Petition for a rehearing and setting aside the decree:—

And now the defendant in said case, not waiving his appeal heretofore entered from said decree, but lest the same should be held not subject to appeal, and desiring a further hearing on the

form thereof, and on the matters set forth in his former petition in this cause filed on said day, and on grounds arising since the filing of said petition, and since the entry of said decree, which he respectfully submits are in the nature of an equitable release of said decree by the parties substantially in interest, which would render the execution of said decree inequitable, or be sufficient to cause this honorable court to relieve him from the same :

Respectfully submits that, since said 23d of September, other owners of land abutting on said passage have consented in writing to the maintenance of said bay-windows, in addition to those represented in said petition to have so consented, so that now every one of the owners of land so abutting has so consented thereto in writing, by the instruments and in the manner to be exhibited. So that your petitioner submits, as aforesaid, that he ought not to be required to remove said windows, and that there is no injury, or, if any, only an uncertain and doubtful injury to any person, so that the court, in accordance with the rule and practice in such cases, will withhold its interposition.

Wherefore he respectfully prays for a rehearing as aforesaid, and that said decree may be set aside, or the execution thereof suspended, by order of this court.

The cause now went again to the full bench for argument upon the appeal, and upon the petition for a rehearing and setting aside the decree. It was, upon motion of the Attorney General, advanced upon the docket for a speedy hearing, and was argued before the court, sitting as a full court for the Commonwealth, November 20th, by the Assistant Attorney General for the Commonwealth, and by George S. Hale, Esquire, for the respondent. The brief for the respondent, covering with great minuteness the law and facts of the case in all their aspects, and including questions which were not now heard or considered by the court, is too voluminous for insertion here, and both briefs are accordingly omitted.

The only new element in the case since the former decree, was the allegation that all the abutters upon the passage-way in question, between Dartmouth and Exeter streets, had given their consent in writing that the respondent's bay-windows should remain; and the argument upon the petition for a rehearing and setting aside the decree, was restricted by the court to this point.

The decision of the court was announced, November 24th, with the following Opinion of the Court, delivered by Mr. Justice Holmes :—

We assume, in favor of the defendant, that the case now stands, for the purpose of the present decision, as if all the abutters on the passage-way, between Dartmouth and Exeter streets, had executed releases in such form as to preclude themselves, or any subsequent purchasers from them, from making any complaint hereafter in respect of the present structures ; but we are of the opinion that, in view of the form of the stipulation in the bond of the Commonwealth to Williams, and the statutes in force when that bond was executed, the rights reserved by the Commonwealth, whether reserved for the benefit of other land, including that owned by itself, or of the public, or both, are not confined to the abutters who have released, and that those abutters could not discontinue the passage-way by private agreement among themselves. If the only purpose had been to create a private way for the use of the adjoining estates between Dartmouth and Exeter streets, we may presume that an easement would have been reserved and granted in the ordinary form, and that the intervention of the Commonwealth, and the cumbrous machinery provided by statute for setting the board of harbor and land commissioners in motion, would not have been thought necessary. Pub. Sts. c. 19, § 5.

The appeal is frivolous. The only matters in the decree of the single justice not covered by the rescript, are the time within which the projections are to be removed, and the question of costs. The record certainly discloses no reason why costs should not be given against the losing party, according to the usual rule. As to the time allowed, the only evidence which we could consider would be that on which the single justice acted, and that evidence is not reported. It cannot have been supposed that we could say, as a matter of law, that thirty days was not ample time to remove bay-windows. These are the only points before the court.

Decree accordingly.

On the same day, November 24, 1885, the full court ordered the following Final Decree to be entered in the case, in affirmance of the decree entered by Mr. Justice Charles Allen, September 23d :—

This cause came on to be heard in the supreme judicial court for the Commonwealth on the 20th day of November, 1885, upon appeal from a final decree by a single justice in pursuance of a rescript of said court, and upon a petition for a rehearing and setting aside the decree, and was argued by counsel; and, thereupon, upon consideration thereof, it is ordered, adjudged and decreed, that the respondent remove within thirty days, at his own expense, the bays or projections into and over the sixteen-foot passage-way laid out in the rear of a certain parcel of land situated on the Back Bay district, in the city of Boston, at the corner of Boylston and Exeter streets, the premises described in the information in this suit; and that the defendant pay the costs.

The case had now reached its last stage. The “final decree” had been entered, and a copy duly served. With the aid of able and devoted counsel, every line of defence had been tried. The respondent had had his day in court. He accepted the final decision against him, and so, without reserve, assured the Board. A few days after the entry of the decree, a request and proposition were made, to which, under the then existing circumstances, and with the approval of the Attorney General, it seemed reasonable to accede.

There had been sufficient reasons why, under some of the aspects which the cause had assumed, the questions and defences raised should have a prompt and final solution by the highest legal tribunal. This had been accomplished; but “the law’s delay” had postponed the result to the verge of winter. The building in question was now occupied by families, and the opening of the walls would involve their removal or great discomfort, and, in some instances, as it appeared, serious risk of health. The proposition of the respondent, after conference between the parties representing or interested on both sides of the case, was put in the form of the following Agreement, which sufficiently indicates the nature and terms of the temporary arrangement made:—

WHEREAS, upon an information [the filing of the information, etc., and the judgment and final decree of the full court for the removal of the bay-windows, are here recited]; and, whereas, it is represented that such removal, if made during the present inclement season of the year, will be attended with much more serious

damage and inconvenience, not only to the owner, but to the lessees and occupants, of the said building, and it is, for this reason solely, asked as a favor and indulgence that the said Williams may be allowed to defer such removal until the time hereinafter specified ; and that, in the meantime, the said attorney general, and the said harbor and land commissioners, will forbear to make further application to said court for compulsory or other process against said Williams touching such removal ; and that the said commissioners will also in the meantime forbear to exercise the right reserved to the commonweath in its deed aforesaid, to enter upon the premises by its said commissioners, and, at the expense of the said Williams, to remove or alter, in conformity with the stipulations of said deed, the portion of said building erected by said Williams contrary to said stipulations :

Now, therefore, in consideration of such forbearance, the said Henry Bigelow Williams, respondent in the suit aforesaid, and Susan S. Williams, wife of said respondent, and Ellen B. Williams and Robert Sturgis, successive grantees of the title and interest of said respondent in said premises, under deeds given pending said suit and subject to said stipulations, do hereby severally covenant and agree, for themselves and their respective heirs, representatives and assigns, that they will, and that each of them does hereby, acknowledge and accept the aforesaid adjudication and decree as final and conclusive, and as absolutely binding in law and equity upon them and each of them, their respective heirs, representatives and assigns, and upon their respective estates and interests in the land and building aforesaid ; that they will not, and neither of them will, directly or indirectly, in said supreme judicial court or in or before any other court, tribunal, board or authority whatsoever, by setting up or availing themselves of any facts, grounds, laws, rights, remedies or reliefs now or hereafter existing, or alleged or supposed to exist, or otherwise in any manner or by any means, further contest or seek to avoid, hinder or modify the full force and effect of said adjudication and decree ; that the said Williams shall and will in any event, and under any circumstances now or hereafter existing, remove or cause to be removed the bay-windows or projections aforesaid in accordance with said decree, except as regards limit of time ; that such removal shall be begun not later than in the month of April next, and shall be fully completed before the first day of July next ; and that said decree shall be and remain in full force until such removal shall have been actually made and completed.

In Witness Whereof, the said Henry Bigelow Williams, Susan S.

Williams, Ellen B. Williams and Robert Sturgis, have hereunto set their hands and seals, this fourth day of December, A. D. 1885.

The foregoing instrument was duly executed by the several parties named in the concluding clause, and acknowledged by one of them, so that it could be made by registration a part of the record of title. The performance of the agreement in good faith, according to the terms thereof, was further guaranteed, under an appended covenant, by a gentleman of high responsibility, interested for the parties though not in the property.

The history of this case has been given with such detail, because the case has attracted much public attention, and because the questions decided in it affect the rights of many persons, and involve the powers and duties of the Commonwealth and its officers in the protection of these rights. The merits of the controversy could not be impartially shown without presenting the opposite views and standpoints of the parties, both upon the facts and the law, in the words which they and their respective counsel had used to set them forth; and the full force and effect of the clear and learned opinions of the court could be adequately given only in the language of the opinions themselves.

Three points have been decided in this case :

That the passage-ways on the Back Bay, under the deeds of the Commonwealth, must be kept open by the abutters their full width, for air, light and prospect, and for other uses, from the ground up to the sky.

That any or all of the abutters between two intersecting streets, cannot, by release, agreement or consent, discontinue or obstruct the passage-way, or authorize it to be done.

That an information in equity, in the name of the attorney general, can be maintained to enforce the stipulations in the deeds in respect to the passage-ways.

Taken in connection with the case of *Attorney General v. Gardiner*, 117 Mass. 492, the decision seems to make the remedy by information one of broad application for the enforcement of the stipulations in the Back Bay deeds.

SOUTH BOSTON FLATS.

Work has been continued upon the area of $99\frac{46}{100}$ acres which was in process of filling at the date of the last Report. There have been deposited upon this area, during the last year, 201,564 cubic yards of material, equivalent when levelled to $8\frac{3}{100}$ acres completed to grade 13, and making, with the work previously done, an equivalent of $82\frac{615}{1000}$ acres in all completed to that grade. In obtaining the material for this filling, about 90 acres of the main harbor of Boston have, in the last and previous years, been deepened to 23 feet at mean low water.

No contracts have been made during the year past for the enlargement of the area already under improvement. Agreements have been entered into for the continuance or extension of time of the existing contracts, for the building of sections of additional bulkhead, and for the strengthening and securing of the bulkheads already built, — copies of which will be found in the Appendix to this Report.

The amount in the "Commonwealth's Flats Improvement Fund" on the first day of January, 1885, available for carrying on the work, was \$70,160.66; to which there have been added during the year \$2,501.12 from rents and income of the fund, and \$100,000 paid into the fund from the treasury of the Commonwealth under the provisions of chapter 314 of the acts of 1884; making a total of \$172,661.78 available for the work. Of this sum, there has been expended during the year \$82,616.48, leaving an available balance January 1, 1886, of \$90,045.30. In order to provide for the completion of the work now in progress, and for any new work which may be undertaken, it will be necessary to renew the appropriation made by chapter 314 of the acts of 1884, which expires by limitation the present year; but it is not anticipated that the requirements of the work will involve any increase of the financial estimates of the Commonwealth for 1886.

No filling has been done by the New York and New England Railroad Company, during the past year, on the adjoining lots, pursuant to the legislative acts and indentures with

the Commonwealth relating thereto. Copies of a notice in regard to the manner of filling, and of the reply of the company, will be found in the Appendix.

Acquisition of Riparian Rights.

For the purpose of clearing up and perfecting the title of the Commonwealth to the flats at South Boston between B and E streets, — the purchase of which, within the line of riparian ownership, had been authorized by chapter 446 of the acts of 1869, and had been substantially accomplished under that and subsequent acts and resolves, — the Board was authorized, by chapter 290 of the acts of 1884, to take, in the name and behalf of the Commonwealth, the whole or any part or parts of the flats in question. All of the flats within the limits prescribed have been taken under that act, except a strip 165 feet wide next to B Street. A suit was pending between private parties involving the ownership of an undivided seventh interest in this parcel, the other six sevenths of which were already owned by the Commonwealth; and it was thought that the title could be adjusted to better advantage after the termination of this suit, by partition or purchase from the prevailing party. The litigation between the parties is not yet ended.

The time for filing petitions for damages by reason of the taking of the flats aforesaid, expired in June last. Only one claim for damages has been made. This claim could not be adjusted on reasonable terms, and the petition of the claimant is now pending in the supreme judicial court for the county of Suffolk.

Appropriations were made by chapter 290 of the acts of 1884, and chapter 70 of the resolves of the same year, for the purposes above mentioned. It may be necessary to renew these appropriations, or to make other provision for such expenditures as may be incurred for these purposes.

Reserved Channel.

In the original plan for the occupation of the South Boston flats, — recommended by the Commissioners on Harbors and Flats in their Report for 1865, sanctioned by the United States Commissioners on Boston Harbor, and approved and

adopted by the legislature by chapter 81 of the resolves of 1866,—a “reserved channel” was laid out over the flats of the Commonwealth, 300 feet wide, running eastward, along and just outside the line of riparian ownership, and entering the main ship channel above Castle Island.

Two objects were to be accomplished by the reservation of this channel. It would prevent the cutting off of private owners of wharves and flats along the shore from access to the sea, thereby saving troublesome questions which might arise from so doing. It would also give an additional frontage for wharves and docks to the land of the Commonwealth which it was proposed to create by filling the flats between this channel and the main ship channel.

This reserved channel was deemed to be so settled a feature of the plan, that Attorney General Train gave an official opinion, in 1876, that the Agents of the Commonwealth, then having the work in charge, could not change the location of the channel as laid down on the plan of 1866.

The idea was conceived, about this time, of utilizing the South Boston flats largely and chiefly for railroad and commercial purposes. It was proposed, by means of a junction railroad, to bring such of the railroads entering Boston as should choose to connect therewith, to this point as a common tide-water terminus, where ample facilities should be afforded to all for the interchange of business with coastwise and ocean vessels and steamships. The reserved channel stood in the way of the convenient development of this scheme; and it was provided by the legislature, by chapter 61 of the resolves of 1877, “That the approval and adoption of the Commissioners’ plan, which were obtained and secured by chapter 81 of the resolves of the year 1866, are, so far as relates to the *reserved channel* thereon laid down, hereby withdrawn and annulled; and the Agents of the Commonwealth for the Commonwealth’s flats at South Boston, are hereby directed to omit said reserved channel in the map to be prepared by them in accordance with the provisions of chapter 239 of the acts of the year 1875.” This seems to amount to a prohibition of the reserved channel as a feature of the general plan.

It is not proposed now to recommend the restoration of

the reserved channel as a binding feature of the plan, nor to discuss its proper width or location if restored. It is not necessary to do so as yet, and such negotiations with riparian owners and other parties as might arise if a channel were to be reserved, could be better conducted if its existence and characteristics were left to a discretionary decision.

The scheme of utilization above referred to was too large in its conception, and involved the disturbance of too many interests already located and established, to be easily realized; and it may, perhaps, be dismissed as a present factor in determining the general plan of occupation. It is, therefore, recommended that a reserved channel be *authorized* by the legislature,—the location and plans for the same, and all contracts relating thereto, to be subject to approval by the governor and council before adoption by the Board.

BOSTON HARBOR.

One of the best results of the work at South Boston, already alluded to in that connection, is the addition of 90 acres to the deep-water areas of Boston upper harbor, while dredging, to the depth of 23 feet at mean low water, for the material deposited in filling the flats. As a part of the same work, the shoal at the mouth of Fort Point Channel, lying between the main ship channel, and Long, Central and India wharves, and the wharves of the New York and New England Railroad Company at South Boston, has been removed to a depth of not less than 20 feet at mean low water, and dredging is now in progress to reduce it to the full depth of 23 feet. These improvements have been made by the Commonwealth, without the aid of appropriations by the national government.

The compensation fund for Boston harbor, which has been raised out of the assessments laid by this Board upon wharf and shore owners, for tide water displaced by licensed structures, has also been availed of for other improvements on a smaller scale, which, though much needed, are out of the range of works for which appropriations are usually made by Congress. A shoal, projecting into the channel at the mouth of Charles River, has been recently surveyed by the engineer of the Board and his assistants, and its removal

will be shortly undertaken at the expense of this fund, adding greatly to the convenience and safety of vessels navigating this portion of the harbor.

There is, however, an improvement, most imperatively needed, for which the national government must provide. That is the widening of the main ship channel of approach to the upper harbor, at the Upper and Lower Middle, off and to the northward and eastward of Buoy No. 9. As Major Raymond has said, in a valuable paper on Boston Harbor, —

This has a least depth of 23 feet at mean low water, and a minimum width of 600 feet; dimensions quite inadequate for the commerce of the harbor, and out of all proportion to the capacities of the outer approaches. The following figures, taken from my last annual report, illustrate this: At a distance of seven miles from the Charlestown Navy Yard, the aggregate width of deep-water channel-way is 1,700 feet; at six miles, 2,300 feet; at five miles, 4,600 feet; at four miles, 2,600 feet; at three miles (which brings us to the inner narrows), 640 feet; at two miles, 1,250 feet; and at one mile, 2,100 feet. Thus all vessels of deep draught, going to the wharves of Boston, are crowded into a narrow defile, and to make matters worse, the entrance to this defile is on both sides rocky and dangerous.

This narrow stretch of channel, Major Raymond advises, “should have a minimum width of 1,000 feet, and a depth of 23 feet at mean low water.” His opinion is warmly endorsed, not only by engineers, but by practical navigators. The Pilot Commissioners for Boston harbor have recently addressed to this Board a pressing communication on the subject. Steamers of the Cunard line have grounded twice the past season on the passage through this “narrow defile,” once outward and once inward bound, having been crowded too far one side in order to avoid collision with passing vessels. Under the most favorable circumstances, it is not unusual for vessels of deep draught to touch on either side. The occurrence of some more grave accident is only a question of time; and the risk of accident tends even now to injure the reputation and interests of the port.

This work, which Major Raymond has urgently recom-

mended in his official reports, can be done with especial convenience and economy at the present time, because the material removed can now be disposed of close at hand in connection with the work on the South Boston flats. The attention of the Massachusetts senators and representatives in Congress is respectfully and earnestly invited to the pressing need of this improvement.

The attention of this Board has also been called to the want of additional and properly located lights along the approaches to the upper harbor. Complaint is made that the difficulties of the passage, already sufficiently great, are made more serious by the absence of such lights. It is alleged by experienced navigators that Boston harbor bears an unfavorable comparison in this respect with other harbors. These complaints seem to be well grounded, and it is hoped that this reference to the matter may aid in directing the attention of the proper board to the needed remedy.

GLOUCESTER HARBOR.

When a harbor line was first established in Gloucester harbor, in 1866, the area of the inner harbor, as bounded by that line, was 143 acres. Ten acts have been passed since 1866 for changing portions of this harbor line, and in each instance the line has been moved out further from the shore, and the reserved area of the harbor encroached upon. These encroachments, taken together, amount to $10\frac{2}{10}$ acres; and the inner harbor, as bounded by its harbor line to-day, contains only $132\frac{8}{10}$ acres.

Boston upper harbor, above Governor's and Castle islands and below the bridges, contains 1,150 acres of reserved area; but what may properly be called the inner harbor of Boston, is the nearly land-locked basin, including the above, protected by Deer and Long islands on the east, and having an area of not less than 6,300 acres. This includes President Roads, in itself containing nearly 1,000 acres of anchorage of the first order, as regards depth, holding ground and shelter.

Boston inner harbor may be fairly said, then, to be more than 47 times as large as Gloucester inner harbor; and, without saying that the former is any larger than it need be,

it may be safely said that the latter is altogether too small for the present and prospective demands upon its capacity.

Gloucester harbor is now the second in importance in the Commonwealth, and the necessity of wise and careful treatment is becoming more apparent every day. Room for movement and anchorage is an essential feature of a good harbor, and it would seem to be wiser, if it were practicable, to set the limit of wharf occupation back nearer to the shore, than to carve off any more from a water space already too contracted.

This harbor was formerly used chiefly for vessels of a much smaller class than the present, and many of the wharves were built so as to accommodate only such smaller craft. The result was, that too much room was given to the wharf, and the dock was made too narrow or too short; so that neither can be used to good advantage for larger vessels. Wharves were also in some localities run out in such directions, and with such neglect of general system and plan, as to serve poorly the present convenience of the owners or of the public.

To remedy these mistakes, the natural tendency has been, with the increase in the size of vessels and the expansion of business, to run the wharves further out into the harbor, instead of enlarging and deepening the docks towards the shore; and frequent changes of the harbor line have been made to allow this to be done. In a harbor of abundant capacity, this might do little harm; but in a harbor of contracted area, it cannot be carried too far without serious injury to the interests of all concerned.

Too frequently, also, wharves have been extended beyond the harbor line without license, or in disregard of the terms of the license; and the unlawful structure, declared by statute to be "a public nuisance," has sometimes even been used as an argument for extending the harbor line so as to take it in.

The Board has felt more and more the importance of doing all in its power for the correction and avoidance of past errors, and for the adoption of such measures as should best tend to preserve and improve this harbor, and make it of the greatest convenience and value to all who use it. With this

view, a careful and thorough resurvey of the whole harbor was undertaken the last season, and more than half of the work has been completed. It is intended to finish the survey the coming season; and then, after a careful study of the harbor in its present condition, and after public notice and hearing, to recommend to the legislature such a harbor line as the best interests of all seem to require, having in view the need of suitable wharves and other structures, as well as the absolute necessity for harbor room.

RECEIPTS FROM GRANTS OF TIDE-WATER LANDS.

The amount paid into the treasury the past year, for grants of rights and privileges in tide-water lands of the Commonwealth, under licenses of the Board, is \$3,037.80; making, with previous receipts from the same source, a total of \$157,779.57 since the passage of the act of 1874 requiring such payments to be made, subject to the discretion of the governor and council in respect to the amount to be charged.

For the first time since the act was passed, a payment has been received the past year for a grant of this character in the harbor of Gloucester.

FIELD AND OFFICE WORK.

Miscellaneous Surveys.

The usual surveys have been made to determine the amount of work done under the several contracts for filling the South Boston flats, and for the direction and supervision of the work in progress; and soundings have been taken to ascertain the depth and condition of the bottom of the harbor as left by the dredging machines in connection with the same work. In addition to the above, the following special surveys have from time to time been made:

In March, a survey of a portion of the Boston and Roxbury Mill Corporation's lands in the Back Bay, lying between Beacon Street and Charles River and west of West Chester Park, was made to determine whether the work performed was in accordance with the requirements of the indenture between the Commonwealth and said corporation.

In the same month, a survey of a portion of Harbor Cove in Gloucester harbor was made, in connection with certain wharf extensions therein.

In May and June, nine new triangulation points were established for the purpose of extending the survey of the shore line of South Boston, and the topography was executed from the Bay State Iron Company's wharves around South Boston Point to the wharf of the Boston Yacht Club.

In the latter part of June, the work of making a resurvey of Gloucester Harbor was commenced, on a base furnished by the United States coast and geodetic survey, and continued until the first part of September. The resurvey of about two-thirds of the harbor proper is completed, from Wonson's Cove in East Gloucester to Harbor Cove in Gloucester.

In August, a survey was made in order to determine the position of a dangerous rock off the Maverick Oil Company's wharf in Chelsea Creek.

In September, a survey was made of the lower part of Hatch's Creek in the boundary line between the towns of Eastham and Wellfleet, with a view to determining the position of that line.

In October, a survey was made of the cove between the Old Colony Railroad wharf and Bar Neck wharf at Wood's Holl, in connection with a wharf extension.

In November, soundings were taken in Charles River Basin above West Boston bridge, over the area dredged by the contractors for building the West Boston park in the city of Boston, and with a view to prescribing the limits of further dredging.

In the same month, soundings were taken in Miller's River, Cambridge, in front of Joseph A. Wellington's wharf, for the purpose of assessing compensation for tide water displaced by the extension of the wharf.

In the same month, a survey was made of the wharves of the A. T. Stearns Lumber Company, in Neponset River at Neponset, for the purpose of assessing compensation for tide water displaced by said wharves.

In December, soundings were taken on a shoal on the west side of the channel at the mouth of Charles River, between

Fiske's and Bartlett's wharves, with a view to an early removal of the shoal.

Licenses Granted and Plans Approved for the Erection of Structures in and over Tide Waters.

Applications for licenses for wharves and other structures in and over the tide waters of the Commonwealth, and for the approval of plans for structures authorized by the legislature, have been as numerous the past year as in previous years, as is shown by the list hereto appended :

Nos.

848. Petition of Henry C. Lumbert for license to construct a pile wharf at Hyannis in the town of Barnstable. Granted January 1, 1885.
849. Petition of John Gilbert and others for license to construct a pile wharf in extension of Atkins' wharf in Boston harbor. Granted January 1, 1885.
850. Petition of the city of Boston for license to construct a head house on piles on the Boston side of the East Boston south ferry. Granted January 8, 1885.
851. Petition of William H. Hart for license to construct a solid wharf and a pile platform in front of the same at Old Harbor Bay in South Boston. Granted February 5, 1885.
852. Petition of Amasa Smith for license to construct a pile wharf in Provincetown harbor. Granted February 5, 1885.
853. Petition of Charles E. Symonds for license to extend his wharf on North River in the city of Salem. Granted February 5, 1885.
854. Petition of the A. T. Stearns Lumber Company for license to extend its wharves on Neponset River at Neponset in the city of Boston. Granted February 12, 1885.
- 855, 855^a. Petition of the Old Colony Railroad Company for approval of plans for the construction of a railroad and railroad bridges across Neponset River in the city of Boston and town of Milton, as authorized by chapter 112 of the Public Statutes. Approved February 12, 1885.
856. Petition of Michael Hurley, John Pluff and J. Otis Marshall for license to construct a stone wall and fill solid the area enclosed by the same in Lynn harbor. Granted February 26, 1885.

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Nos.

857. Petition of the Onset Bay Grove Association for license to construct a wharf on Swift's River in the town of Wareham. Granted February 26, 1885.
858. Petition of Stephen N. Breed for license to extend his wharf on piles in Lynn harbor. Granted February 26, 1885.
859. Petition of the city of Salem for approval of plans for dredging and filling flats, and for building a canal in said city, as authorized by chapter 185 of the acts of 1883, and chapter 194 of the acts of 1884. Approved March 5, 1885.
860. Petition of the Trustees of the estate of John Carter Brown for license to extend French's wharf, so called, on Fort Point Channel in the city of Boston. Granted March 26, 1885.
861. Petition of Cyrus Patch for license to construct a pile wharf and to dredge in front of the same in Weymouth Fore River in the town of Quincy. Granted March 19, 1885.
862. Petition of the Newburyport Quarry Company for license to place temporary mooring stones in Merrimack River in the city of Newburyport. Approved March 26, 1885.
863. Petition of Annie M. Oakes for license to extend her wharf on Chelsea Creek in the city of Chelsea. Granted March 26, 1885.
864. Petition of the Onset Bay Grove Association for license to reconstruct and rebuild its bridge over Swift's Narrows at Onset Bay in the town of Wareham. Granted April 9, 1885.
865. Petition of Benjamin Hodgkins for license to construct a wharf on piles in Gloucester harbor. Granted April 23, 1885.
866. Petition of Burnham Brothers for license to extend their easterly pier on piles in Gloucester harbor. Granted April 23, 1885.
867. Petition of Phillips, Taylor and Company for license to enlarge their wharf on Chelsea Creek in the city of Chelsea. Granted April 30, 1885.
868. Petition of the Atlantic Works for license to extend its wharf at East Boston. Granted April 30, 1885.

Nos.

869. Petition of the Eastern Railroad Company for license to construct a solid road-bed with open culverts over Saugus River in the city of Lynn and town of Saugus. Granted May 7, 1885.
870. Petition of Taylor, Goodwin and Company for license to construct a solid wharf on Merrimack River in the town of Bradford. Granted May 14, 1885.
871. Petition of the Beverly Gas Light Company for license to extend its wharf on Bass River in the town of Beverly. Granted May 14, 1885.
872. Petition of John C. Nichols for license to construct and maintain a pile platform in extension and enlargement of Caswell's and Barnard and Hittinger's wharves on Charles River, Charlestown District. Granted May 21, 1885.
873. Petition of J. W. Hayward, H. D. Atwood and Charles F. Baker for license to construct a solid wharf with a float attached in Red Brook harbor in the town of Bourne. Granted May 21, 1885.
874. Petition of the city of Boston for license to construct a pile wharf on Eastern Avenue adjoining the East Boston ferry in said city. Granted June 4, 1885.
875. Petition of George H. Wood, Trustee, for license to construct a wharf and plank walk in Boston harbor in the town of Winthrop. Granted June 11, 1885.
876. Petition of the Clark's Cove Guano Company for license to extend and enlarge its wharf in Clark's Cove in the town of Dartmouth. Granted June 18, 1885.
877. Petition of the Boston, Winthrop and Shore Railroad Company for license to drive piles along the channel leading to its wharf on Point Shirley in the town of Winthrop. Granted June 25, 1885.
878. Petition of Thomas Gaffield for license to construct a pile wharf in and over the tide waters of Buzzard's Bay in the town of Bourne. Granted July 2, 1885.
879. Petition of the New York and New England Railroad Company for license to construct a floating bridge in its proposed Dock No. 3 on the South Boston flats. Granted July 16, 1885.
880. Petition of Ella S. Thayer for license to construct a temporary floating stage and walk in Hingham harbor. Granted August 6, 1885.

Nos.

881. Petition of the Gosnold Mills Corporation for license to extend its wharf on Acushnet River in the city of New Bedford. Granted August 6, 1885.
882. Petition of William B. Rice for license to construct a wharf on Broad Sound in the town of Winthrop. Granted August 6, 1885.
- 883, 883^a, 883^b. Petition of Horace S. Crowell for approval of plans for building a causeway or bridge from a point on Scon-ticut Neck in the town of Fairhaven to Long Island, and thence to West Island, as authorized by chapter 298 of the acts of 1885. Approved August 13, 1885.
884. Petition of the Old Colony Railroad Company for license to fill solid and to widen portions of its railroad bridge and causeway across Taunton Great River between the town of Somerset and city of Fall River. Granted September 10, 1885.
885. Petition of John C. Terry, D. M. Anthony, C. W. Anthony, Nathaniel B. Horton and Hiram Horton for license to construct a wharf and a marine railway on Taunton Great River in the city of Fall River. Granted Sep-tember 10, 1885.
886. Petition of the city of Salem for approval of plans for taking land and flats for the abatement of a nuisance in said city, for filling and dredging said flats, and for building a canal, as authorized by chapter 185 of the acts of 1883 and chapter 194 of the acts of 1884. Approved September 17, 1885.
887. Petition of the city of Salem for license to construct a pile plank sewer in North River in said city. Granted September 17, 1885.
888. Petition of the Eastern Railroad Company for license to construct a floating bridge at the head of its dock in East Boston. Granted September 17, 1885.
889. Petition of Robert Fears for license to extend on piles his wharf on Harbor Cove in the city of Gloucester. Granted September 17, 1885.
890. Petition of the Eastern Railroad Company for license to widen its railroad bridge and causeway across Mystic River in the city of Somerville and town of Everett. Granted September 17, 1885.
891. Petition of Sophia L. Jackson for license to construct a stone pier in Mattapoissett harbor in the town of Matta-poissett. Granted October 1, 1885.

Nos.

892. Petition of Charles Hodgkins and Stephen A. Tarr for license to construct a stone pier at Milk Island in the town of Rockport. Granted October 8, 1885.
893. Petition of the Boston Dyewood and Chemical Company for license to construct a pile platform in front of its wharf at East Boston. Granted October 15, 1885.
894. Petition of the Board of Park Commissioners of the city of Boston for approval of plans for the erection of structures for public park purposes at South Boston Point, as authorized by chapter 360 of the acts of 1885. Approved October 15, 1885.
895. Petition of Daniel F. Lewis for license to construct a pile wharf in Provincetown harbor. Granted October 15, 1885.
896. Petition of Alfred C. Hersey for license to construct a sea wall and to fill certain flats in Hingham harbor in the town of Hingham. Granted October 22, 1885.
897. Petition of the Gloucester Gas Light Company for license to construct a sea wall around its present pile wharf, and to fill solid the area enclosed by the same, in Gloucester harbor. Granted October 29, 1885.
898. Petition of Martin Brimmer for license to construct an addition on piles to T wharf in Boston harbor. Granted October 29, 1885.
899. Petition of Charles E. Davis for license to construct a wharf partly solid and partly on piles in Great Harbor at Wood's Holl in the town of Falmouth. Granted November 12, 1885.
900. Petition of the Putnam Nail Company for license to construct wharves and embankments in Neponset River at Neponset in the city of Boston. Granted November 12, 1885.
901. Petition of John Pickett for license to build a bulkhead or stone wall and fill solid a part of his dock in Beverly harbor. Granted November 12, 1885.
902. Petition of the Trustees of the estate of John Carter Brown for license to construct a pile dolphin in front of French's wharf on Fort Point Channel in Boston harbor. Granted November 19, 1885.
903. Petition of Joseph A. Wellington for license to extend his wharf on piles, and to fill solid the dock adjoining the same, on Miller's River in the city of Cambridge. Granted November 25, 1885.

Nos.

904. Petition of Nathaniel P. Brooks for license to fill solid a part of his dock in Miller's River in the city of Cambridge. Granted December 3, 1885.
905. Petition of Sarah S. Lefavour for license to construct an extension to her wharf, partly solid and partly on piles, in Beverly harbor. Granted December 24, 1885.
906. Petition of George H. Fuller and others for license to construct a pile wharf in Cotuit Bay in the town of Barnstable. Granted December 31, 1885.
907. Petition of the heirs of Maria T. Tileston for license to extend their wharf at the head of their dock in Fort Point Channel in Boston harbor. Granted December 31, 1885.

BOSTON AND ROXBURY MILL CORPORATION.

By indentures entered into by and between the Commonwealth and this corporation, dated June 9, 1854, the then commissioners of the Commonwealth, and their successors, were given the power and charged with the duty of devising and prescribing a plan for the laying out of the lands of the corporation, situate in the Back Bay district between Beacon Street and Charles River,—such plan to require for streets and other public uses not more than one-third part of said lands. This duty was performed by the predecessors of the present Board in respect to a portion of the lands, but no plan or record of their final action, convenient for reference, is in existence.

During the last year, a plan, dated May 28, 1885, and covering all the lands now, or at the date of the indentures, owned by the corporation, has been “devised and prescribed” by the Board, on which the portions set apart for streets and other public uses are definitely shown. No changes are made as regards the location and width of the streets on the area already built over, and the whole plan conforms as nearly as may be to the general plan of streets and ways on which the rest of the Back Bay district has been laid out.

The plan has been definitely accepted and agreed to by the corporation, and authorized to be recorded in the Suffolk registry of deeds, and will be so recorded.

HARBOR IMPROVEMENTS BY THE UNITED STATES.

Major Charles W. Raymond, of the United States Corps of Engineers, with headquarters at Boston, has continued in charge of the works of the national government in the harbors and rivers on the eastern coast of Massachusetts, and Lieut. Col. George H. Elliot, with headquarters at Newport, in charge of those upon the southern coast.

The Board has had occasion to seek, and has received, valuable advice and assistance, cheerfully and courteously given, from both of these gentlemen.

Since this Report was begun, the Board has heard with sincere regret of the contemplated transfer of Major Raymond, by order and assignment of the Chief of Engineers, to another and remote section of the coast of the United States. During his three years of service at his present station, he has not only shown in a high degree the qualities of an able and thorough engineer, and an officer competent to all the duties of his position, but has brought to his work zeal and industry, personal interest and enthusiasm, and a determination by careful and diligent study to make himself master of the whole field under his charge. The happy results of this devotion have been more apparent year by year, and the loss of the full fruits of his study and thoroughly furnished skill will be seriously felt by all who have been conversant with the character and value of his services.

Improvements on the Eastern Coast of Massachusetts.

At the request of the Board, Major Raymond has furnished a condensed report of the work done in the harbors and rivers under his charge during the year 1885. He has also embodied in the report a statement of some of the effects upon the coast of the severe storm of the last week of November. This storm was so remarkable in its duration and violence, and in the height of the tides which it produced, and in the changes which it wrought upon the beaches and shores, that, upon the suggestion of Prof. Henry Mitchell of the Coast Survey, a circular letter was sent to officers of ports, keepers of light houses, and others having special occasion or opportunity to observe its

effects, asking for the facts as observed by them, with a view to their preservation for future reference; and the many answers received have been filed for such use. Major Raymond's reply to this circular letter is made a part of his following report:—

UNITED STATES ENGINEER OFFICE,
BOSTON, MASS., December 31, 1885.

The Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN:—In compliance with your request of the 7th instant, I take pleasure in sending you the following abstract of work done under my charge, by the general government, in the harbors and rivers of Massachusetts, during the past year. I have further added some information regarding the effects of the violent storm of last November, as requested in your circular letter of November 30, 1885.

1. Newburyport Harbor.

The submerged core of the north jetty, the top of which is in the plane of mean low water, has been extended for a distance of 250 feet. The total length of the jetty is now 2,675 feet, 1,540 feet being completed to the full height. During the year, 9,700 tons of stone have been placed in position. The core of the south jetty has been extended 23 feet, 400 tons of stone having been placed in position. The total length of the jetty is now 1,300 feet, 1,077 feet being completed to the full height. Much of the stone deposited in both jetties was used in levelling up low spots.

The catch-sand constructed last year in rear of the south jetty was strengthened, and its height was increased for a distance of about 500 feet. Minor repairs were made to the dike at the mouth of Plum Island Basin. Three ledges in the harbor channel were cut down to the plane of 9 feet below mean low water (16.7 feet below mean high water), 52 cubic yards of material being removed.

Frequent surveys of the bar and entrance to the river, and of the shore lines, have been made for the purpose of watching the changes now in progress. Among these, the close and extended surveys made just before and after the spring freshet are of especial interest, since they furnish the data for the determination of the relative influence of the freshet in producing scour,—an element of the highest importance in connection with the probable permanency of the completed improvement. A detailed survey was also made to connect those of the river's mouth with the engineer survey above the Eastern Railroad bridge.

The November storm did not injure the jetties or the dike. The catch-sand accumulated a large quantity of sand, especially on the part nearest the south jetty. The sea broke in at the head of the cove northwest of the jetty, underwashing the contractor's railway track for a distance of 250 feet. One spur of the catch-sand was demolished at the southwest end, and the filling was washed out from about 20 feet of the main line.

The effect of a northeast storm is generally to cut back the high water line of the beach northwest of the south jetty, threatening to open eventually a new channel in rear of the shore extension, and thus destroy the improvement. The effect of the recent storm has, however, been to improve the beach rather than to injure it. The head of the cove near the south jetty has moved 600 feet to the northwest. The high water line which, before the storm, followed closely parallel to the north side of the jetty, is now 600 feet distant from the south end of its shore extension.

A slight abrasion was noticed in Salisbury Beach, the sea having undermined a part of the "Old Fort." A few ranges and tripods, used in the progress of the work, were overthrown and destroyed.

2. *Sandy Bay, Rockport.*

The project for a breakwater to form a harbor of refuge, has been the subject of further study. The construction of the substructure has been commenced by placing broken stone on the line of the breakwater on and near Avery's Ledge, under a contract with the Rockport and Pigeon Hill granite companies, which provides for placing in position about 128,000 tons of stone. This will complete the substructure for a distance of about 1,285 feet. Work was commenced on November 9th, and about 2,755 tons of stone have been deposited.

The November storm produced a very violent sea and a heavy undertow. Stones weighing as much as 8 tons were pulled out by the sea from the breakwaters of the Rockport and Pigeon Hill granite companies, and the slopes were flattened. The range marks on the Dry and Little Salvages, and the spindle on Avery's Ledge, which was established to guide the construction of the substructure of the breakwater, were covered with kelp, tons of which were raked by the undertow from the ledges. On the fourth day of the storm, all the ranges on the Little Salvages, one on the Dry Salvages, and the spindle on Avery's Ledge were battered down. These marks were constructed of 3 and 4 inch heaviest lap-welded iron pipe, set over bolts in the ledges and guyed by iron rods.

3. *Lynn Harbor.*

Two comparative surveys were made for the investigation of changes in the channels recently dredged in this harbor.

The violent November gale produced no marked effects on the channels. The tide rose to a level of 13 feet above mean low water, as observed in a sheltered locality and transferred by leveling to the tide gauge.

4. *Boston Harbor.*

Minor repairs were made to the northern and southern walls at Deer Island.

A detailed hydrographic survey of a portion of the Lower Harbor was made, as the basis of a project for future preservation and improvement.

During the violent November gale, the tide rose in the Lower Harbor to 13.25 feet above the plane of mean low water, as determined by observations at the Lovell's Island wharf. At Point Allerton, no changes were noted on the eastern shore. The sea-wall and apron are in good order, and large quantities of gravel and shingle have collected in front of them. The northern shore, from the western end of the sea-wall to the junction of the shore with Stony Beach, has been considerably abraded. The grass-covered slopes of the upland have been washed away for a width of from 5 to 15 feet, and the slight bulkheads built in 1882-3 by private owners for the protection of their cottage-sites, have been almost entirely destroyed. The crest-line of the shore proper has retreated, on an average, 10 feet, and the mean high water line, 6 feet. Above the low water line, the shore has been stripped of large quantities of shingle and boulders, and thus, in many places, the underlying clay is directly exposed to the action of the water. The shore, especially at the junction with Stony Beach, has been so much weakened that it will be necessary to commence the construction of works for its protection as soon as possible.

Stony Beach was not materially affected by the storm, but it was considerably abraded at its junction with the eastern slopes of the northern face of Telegraph Hill, where the Nantasket Beach railroad crosses its crest.

The northerly bluff of Telegraph Hill facing the main ship channel, and the shore in its vicinity, show marks of the severity of the storm. For a distance of 1,700 feet from the eastern end, the sloping base of the bluff has been cut away for a width of from 1 to 16 feet, and a steep bank formed. The rough face of the bluff has become more deeply gullied, and its sod-covered top,

now much undermined, will doubtless waste rapidly away during the spring thaws. The western part of the bluff, with its more gentle slopes, has suffered very little from the storm, being protected for the most part by the solid dam of the Nantasket Beach railroad and the light apron of rubble stone in front of it; but where the track rests on trestles, the base of the bluff has been abraded. The track has been much washed out, and the apron almost destroyed. The mean high-water line below the bluff, and for several hundred feet west of it, appears to have fallen back 6 to 8 feet. Considerable gravel and shingle have been washed from the northern shore of Windmill Point, the crest of the shore having retreated about 8 feet. The effects of this storm upon this important headland and the adjoining beaches, demonstrate the necessity for the construction of works of protection as soon as possible.

At Great Brewster Island, some of the coping course of the wall on the east side has been displaced, and the wall and jetties have suffered other minor injuries. Large quantities of fine gravel have collected along the wall. The western shore has been considerably abraded, especially between the stone bulkhead of the former wharf and the west end of the sea-wall, where the mean high-water line has fallen back about 8 feet.

The Brewster Spit has been increased in width and height at its weakest parts, by gravel and shingle derived principally from the western shore of Great Brewster Island. This is proved by the deposit upon the spit of marked pieces of brick, which were placed on the shore of the island for the purpose of making drift studies. The western end of the spit has not materially changed, although the slopes appear somewhat more rounded.

At Lovell's Island, the sea-walls, jetties and aprons have well protected the shores. Large quantities of gravel and shingle have been collected. The works have suffered a few slight injuries, which can be easily and cheaply repaired.

At George's Island, the sea-wall of the eastern shore suffered some slight injuries. The northern part of the western shore was considerably abraded, the crest being cut back on an average about 6 feet. On the southwest shore there has been a similar abrasion, and in some places a steep bank, about 4 feet in height, has been formed.

At Gallop's Island, the shore has been lowered at the eastern end, the mean high-water line having retreated about 8 feet. The west and south shores have been considerably abraded, especially south of the western end of the sea-wall. The apron built in 1883 has well protected the northern shore, and has sustained no serious

injury. It has suffered minor damages, as has also the apron in front of the sea-wall.

At Rainsford Island, the reconstructed sea-wall and aprons have well protected the shores, and have suffered no material injury.

At Long Island, the sea-wall and its apron are generally in good condition, and have well protected the shore. Along the north-west shore, the crest and high-water line have been forced back about 6 feet. On the southeast shore, west of the apron at the southern end of the sea-wall, the shore bank has been abraded very irregularly, having fallen back on an average about 7 feet, and a steep bank about 7 feet high has been formed in some places.

At Deer Island, the crest of the eastern shore, where not protected by sea-walls, has been forced back about 5 feet. The crest of the northern shore, west of the sea-wall at the North Head, shows an average abrasion of about 6 feet. A considerable part of the coping course of the sea-wall at the South Head, has been displaced. The walls suffered other minor injuries which can be readily and cheaply repaired.

At Castle Island, the only injury was some irregular abrasion at the eastern shore of the southern end of the island.

5. *Scituate Harbor.*

The work of dredging the bar at the entrance of this harbor was continued, and the "deep hole" was enlarged to a depth of 7 feet at mean low water over an area of 200 by 160 feet. The improved channel is now 1,600 feet long, 100 feet wide and 5 feet deep at mean low water. The total amount of material removed is 22,724 cubic yards, of which 11,394 cubic yards were removed during this year.

Surveys were made of Stage House Beach, Cedar Neck and the dredged areas. The latter show no filling.

The violent November storm did not materially injure the break-water. The beach at Cedar Neck and its works of protection were, however, considerably damaged. The apron in front of the brush bulkhead was uncovered through its whole length, the sand between the bulkheads was washed out, and 160 linear feet of the brush bulkhead was demolished. The dunes between the plank bulkheads were undercut. The natural drift of the sand will partly repair this damage, but the restoration of the works is necessary.

6. *Plymouth Harbor.*

No operations have been in progress during the year.

The effects of the violent November storm on Long Beach, the natural mole of this harbor, were beneficial rather than injurious. The southerly part of the beach was covered, up to its crest, with large quantities of cobble stones and shingle, thrown up by the sea, and forming a natural apron. The area of the northerly part has been greatly enlarged by the collection of sea-weed and sand. In some places, where works of protection were thought necessary, the beach has been raised so that such works are no longer required.

7. *Provincetown Harbor.*

Several deep and extensive gullies, formed by storms in the dunes above the beach near Abel Hill dike, were filled with brush and timber sand-catches. A detailed hydrographic survey was partly made of the House Point Island flats and the southern part of the harbor.

During the violent November storm, the tide rose to 13.2 feet above mean low water, or 4 feet above mean high water. The extreme high water, combined with the heavy sea, caused great changes in many places.

Long Point has been strengthened, the stone bulkhead and groins having collected sand. The beach between Wood End and Lancy's harbor has been weakened, several gullies having been formed north of Abel Hill dike.

House Point Island was entirely swept away. Nothing remains of it above high water.

At the west end of the town, the shore was much abraded, the bank in one place receding about 20 feet. Bulkheads of piles and planks were destroyed, and house-lots were abandoned, the houses being moved across the street.

At Beach Point, the works were not injured. The "Outer Beach," north of Salt Meadow, is in better condition than for many years past, especially at Cove Section, where the beach has continued to increase since the construction of the brush bulkhead and jetties in 1875.

Great damage has been done to other beaches not connected with the preservation of the harbor. The stretch of beach from opposite High Head dike to Race Point light, has suffered severely. Opposite the High Head life-saving station, the beach has been lowered, and the sea has broken through, so that, at the time of the storm, the location of the station was under water. Half a mile west of this station, at a place called "Claribel Hollow," the

sea made a breach 200 feet wide, through which the water rushed with great velocity, filling the hollow to a depth of 10 feet. Beyond this point, it is reported that the bank has been cut away in many places; and that there is danger of an extension of Race Run through the beach, and a separation of the light station from the main land.

The sudden and extensive changes to which these beaches are subject, are often facilitated by the careless actions of men. Boats are hauled over beaches, already weakened and undercut, lowering the crests, and making places for an easy breach. Beach grass is carelessly and sometimes maliciously burned. Trees are destroyed for fuel, when their value is much greater as a prevention of the drift of sand. These are matters which it is impracticable for the general government to control, and to which I respectfully invite your attention.

During the year, a number of reports and projects with a view to future improvements, have been submitted to the Engineer Department. For further and more detailed information concerning these, and the works under my charge, I beg to refer to my annual report for the fiscal year ending June 30, 1885, which will be transmitted to you as soon as printed. The work done has been much less than usual, as Congress made no appropriation for last year for these improvements.

Since the commencement of this report, on December 26th, our coast has suffered from a violent northeasterly storm, the effects of which, it is feared, have been much more injurious than those of the storm of last November. At Plymouth and Scituate, and in Boston Harbor, serious injuries are reported, but detailed information has not yet been obtained.

In conclusion, I will again refer to an important and much needed improvement, mentioned in my report of last year, and which your Board fully endorsed, — the widening of the main ship channel in Boston Harbor at the Upper and Lower Middle. During the past year, complaints of the inadequacy of the present channel have been frequent. Many vessels have struck or grounded on its borders. Among others, two steamers of the Cunard Line have suffered injury; and it seems probable that, unless this channel is put in proper condition, such vessels will soon seek other ports, where the conditions of navigation are less complicated.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,

Major of Engineers.

Improvements on the Southern Coast of Massachusetts.

Lieut. Col. Elliot has kindly furnished an advance copy of his report of the work done in the harbors and rivers under his charge, during the year ending June 30, 1885, from which the following extracts are made:—

Hyannis Harbor.

The river and harbor act of July 5, 1884, provided for a preliminary examination and for a survey of Hyannis Harbor, with a view of deepening the harbor, and an estimate of the cost of the improvement proper to be made. Reports of the preliminary examination and of the survey were transmitted to Congress; * * * but as Congress has not yet acted on the project submitted, the estimate of its cost is not included in the "amount (estimated) required for the completion of existing project." * * * Amount available, July 1, 1885, \$105.48.

Nantucket Harbor.

At the beginning of the last fiscal year, the extension of the western jetty was in progress, * * * and it continued until August 30, 1884, when the contract was completed. * * *

It had been intended to devote the appropriation expected to be made by the river and harbor act of the first session of the Forty-eighth Congress, to the commencement of the construction of the eastern jetty; but the amount appropriated by the act of July 5, 1884, was so small, that it was deemed better for the public interests to let it remain in the Treasury unexpended until another appropriation should be made, and the two could be combined in one contract. No other work, therefore, was done in the fiscal year ending June 30, 1885, except some additional observations of the tidal currents, a small amount of work on the spurs at Coatue, and the lighting of the outer end of the western jetty. * * *

The work required to be done to complete the existing project, is the construction of the eastern jetty, the completion of the western jetty, and the excavation by dredging of so much of the channel as is not excavated by tidal scour. * * * Amount available, July 1, 1885, \$9,788.75.

Wood's Holl Harbor.

The amount expended during the last fiscal year, including liabilities outstanding June 30, 1885, was \$41,023.92. The masonry walls of the pier-basin were completed; the interior of the pier-basin and the berths for public vessels at the wharves were dredged to the required depths, and the coal, the west and the cross wharves were essentially completed.

No appropriation having been made at the last session of Congress, no work will be done during the next fiscal year. * * *

There yet remain to be constructed the south and east wharves. In addition to the above, there should be removed a large rock (estimated at 22 tons) from the strait of Wood's Holl, which is extremely dangerous to the steamers which, in summer especially, carry immense numbers of passengers daily to and from Nantucket and Martha's Vineyard. The channel is very narrow, and the tidal currents are very rapid and irregular, so that under the best of circumstances the motions of the steamers are controlled with difficulty, and in foggy and thick weather there is always danger of an accident which may involve great loss of life. It is estimated that under competitive proposals the cost of removal of the rock will not exceed \$500. * * * Amount available, July 1, 1885, \$64.00.

Wareham Harbor.

At the beginning of the last fiscal year, no work was in progress. In September, 1884, a thorough survey was made of the bottom of the river, to discover what changes had occurred since the former dredging, and to enable me to plan the work to be done under the appropriation of \$10,000 made by the act of Congress of July 5, 1884. * * * The amounts of material removed during the year were 3,225 cubic yards of dredged material and 13 cubic yards of bowlders. * * *

With the remainder of the appropriation of July 5, 1884, it is proposed to carry on the work of improvement according to the present approved project, and as far as the funds will permit. * * * No appropriation having been made for this work at the last session of Congress, no other work will be done during the next fiscal year.

The work required to complete the existing project, will be the excavation of the channel to its full width and depth, from the point to which it will be carried by the current contract, down to the deep water above Long Beach. There will also be required

the expenditure of a few hundred dollars in the further building up of Long Beach. * * * Amount available, July 1, 1885, \$8,532.67.

Taunton River.

At the beginning of the last fiscal year, the work of dredging in the channel between Berkley Bridge and Peter's Point was in progress. * * * 2,713 cubic yards were removed from the shoal opposite Wikamount, and the shoal just above Peter's Point. * * *

In August, 1884, a vessel with steam-hoisting apparatus, and a diver were employed in removing 42.4 cubic yards of bowlders, which had been uncovered by dredging between Peter's Point and Church's Wharf, and were dangerous to navigation. * * * The work under the current contract has removed the major part of the gravel and bowlders which covered the ledge at Peter's Point. * * * A considerable portion of the shoal below Peter's Point has also been removed.

With the available remainder of the appropriation of July 5, 1884, it is proposed to carry on the work of improvement according to the approved project, for the completion of which it is hoped the funds will be sufficient.

The current contract will complete the channel from the upper part of the Nook down to the lower end of the improvement at the deep water of the river off Dighton. There will then remain the enlargement of the channel to its full width from Berkley Bridge down to the upper part of the Nook, and a little widening of the channel at a few places above the bridge, for which another contract will be necessary. * * * Amount available, July 1, 1885, \$22,529.56.

THE CONNECTICUT RIVER.

The general court passed, at the last session, the following "Act in relation to the Conservation of the Connecticut River": —

[Chapter 344 of the Acts of 1885.]

SECT. 1. The board of harbor and land commissioners shall have the general care and supervision of the Connecticut River within the confines of this Commonwealth, and of the banks thereof, and of all structures therein, in order to prevent and remove unauthorized encroachments and causes of every kind which may in any way injure the said river, and in order to protect and develop the rights and property of the public therein. In order that they may ascertain and promote the best methods for the preservation and improvement of said river, and for the promotion of all interests connected therewith, as the public good may require, they may from time to time make such surveys, examinations and observations as they may deem necessary for the aforesaid purposes.

SECT. 2. All persons that are or may be authorized by the general court to build any structures in said river, shall proceed in the manner provided in section eight of chapter nineteen of the Public Statutes, and shall be subject to the provisions of said chapter.

SECT. 3. Said board may authorize and license any person to build and extend a wharf, pier or shore wall, below high-water mark in said river, upon such terms as they shall prescribe; and to every proceeding for a license under this chapter, the provisions of sections ten, eleven and twelve of chapter nineteen of the Public Statutes shall apply.

SECT. 4. Nothing in such license or authority shall be so construed as to impair the legal rights of any person.

SECT. 5. Said commissioners, as soon as funds shall be appropriated therefor, shall cause to be surveyed and plotted, on such scales as they shall determine, the whole of that portion of said Connecticut River which lies within this Commonwealth; and the records and maps of the same shall be preserved in the office of said commissioners.

SECT. 6. Said commissioners shall cause to be prepared, for each of the counties of Hampden, Hampshire and Franklin, a copy of the survey or map of the river within the confines of the respective counties; which copies shall be attested by the commissioners,

and deposited in the registry of deeds for the county to which it relates; and said map, when so prepared, attested and deposited, shall be deemed matter of public record, and the same or duly attested office copies of the same shall be competent evidence of the facts contained therein.

SECT. 7. This act shall take effect upon its passage.

The reasons which led to the passage of this act, and the objects had in view, were explained in the last report. It has the effect of giving to this Board a jurisdiction over the Connecticut River, within the confines of this State, similar to that which it has over tide waters,—particularly in respect to the regulation of structures and the prevention of unauthorized encroachments upon the river.

The Board will probably be able to exercise this general supervision without any special provision for the expense attending it; but those most interested in the passage of the act had something beyond this in view. They contemplated, as the act shows, the making of surveys and maps, and the taking of observations, as the basis for a record of the changes in the river, and for a study of its régime, with a view to ascertaining the best methods of checking the serious and alarming ravages which it is making in some places upon its banks, and of preserving and improving the river in the general public interest.

It should be understood that the Board is willing to attempt this work, but that it will involve a cost which, though not necessarily large in any year, will exceed the usual provision for tide-water work alone. The act recognizes this fact, by providing in § 5 that this special work shall be undertaken “as soon as funds shall be appropriated therefor.” Attention is called to this matter, not for the purpose of urging in the behalf of the Board any action by the legislature, but in order that the inaction of the Board may not be misunderstood.

JOHN E. SANFORD.
JOHN I. BAKER.
JOSEPH K. BAKER.

APPENDIX.

APPENDIX.

[A.]

[See page 48 of this Report, *ante*.]

AN AGREEMENT, MADE THIS FIRST DAY OF AUGUST, 1885, BY AND BETWEEN THE NEW ENGLAND DREDGING COMPANY, PARTY OF THE FIRST PART, AND THE COMMONWEALTH OF MASSACHUSETTS, PARTY OF THE SECOND PART.

WHEREAS, the said parties have heretofore, to wit, on the twelfth day of August, 1881, entered into certain Articles of Agreement in relation to the dredging of certain material and the depositing of the same on certain flats in South Boston, which articles of agreement are to be referred to as a part hereof;

And, Whereas, the said Articles of Agreement have been modified in certain respects by a subsequent Agreement made by and between said parties on the twentieth day of June, 1884, which agreement is also to be referred to as a part hereof;

And, Whereas, all the work stipulated to be done by said party of the first part under said original articles of agreement, as modified by said subsequent agreement of June 20, 1884, was, by the terms thereof, to be completed on or before the eighteenth day of August, 1885;

And, Whereas, the said work cannot be conveniently completed within the time aforesaid, and it is desirable that further time be allowed therefor;

Now, therefore, it is agreed by the parties hereto, that the time to be allowed for executing and completing the work stipulated to be done by said party of the first part as aforesaid, shall be, and is hereby, extended to the first day of April, 1886; but such extension shall not be construed to postpone any payments, including the percentage of contract price reserved, which may become due to said party of the first part from said party of the second part, upon the final completion and acceptance of the work aforesaid, at any date prior to said first day of April, 1886.

And, Whereas, the said parties have also heretofore, to wit, on the first day of July, 1882, entered into certain other Articles of Agreement in relation to material dredged by other parties, and the depositing of the same by said party of the first part on a certain other area of flats in South Boston, which last named articles of agreement are also to be referred to as a part hereof;

And, Whereas, by the aforesaid subsequent agreement of June 20, 1884, said last named articles of agreement were extended and continued in force for the term of one year beyond the original term thereof, and were also modified as regards the area of flats to be filled as specified and described therein;

And, Whereas, said last-named articles of agreement as so extended expire on the eighteenth day of August, 1885:

It is hereby further agreed by the parties hereto, that the said last-named articles of agreement shall be, and hereby are, extended and continued in force for a still further term of one year, four months and fourteen days, so as to expire on the first day of January, 1887; but such extension shall not operate to further postpone the payment to said party of the first part of the percentage of the contract price reserved by said party of the second part, upon work finally completed on or before said eighteenth day of August, 1885, and accepted by said last-named party.

It is also further agreed by the parties hereto, that there shall be substituted for the area of flats to be filled as specified and described in said subsequent agreement of June 20, 1884, a certain other area, which includes a portion of the former, and is bounded as follows, to wit: Northerly by the southerly boundary line of the area first described in the articles of agreement first above named, dated August 12, 1881; Southerly by a line drawn parallel to and eight hundred feet distant southerly from said southerly boundary line; Easterly by a line drawn one hundred feet east of and parallel to the easterly line of D Street extended; and Westerly by the westerly line of C Street extended.

It is also further agreed by the parties hereto, that, as the material dredged by other parties is likely to be furnished at irregular times and in varying quantities, said party of the first part shall not be required to keep its dredge, locomotives, cars and other appliances constantly equipped for handling the same, but only when the pockets provided for the reception of such material are full; and that the dumping of such material from scows at said pockets shall be allowed only for the space of an hour and one half before and after high water.

Nothing herein contained shall be so construed as to change or impair any of the provisions of either of the aforesaid Articles of

Agreement, dated respectively August 12, 1881, and July 1, 1882, or of the aforesaid subsequent Agreement, dated June 20, 1884, except so far as they are modified by the express provisions of this agreement.

IN WITNESS WHEREOF, the said NEW ENGLAND DREDGING COMPANY, by Charles H. Souther, its President and Treasurer, thereunto duly authorized, has caused its corporate seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf; And the said COMMONWEALTH, acting by its Board of Harbor and Land Commissioners, has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf, the day and year first above written, and the same to be approved by its Governor and Council.

NEW ENGLAND DREDGING COMPANY,

BY CHARLES H. SOUTHER, [SEAL OF THE NEW ENGLAND
DREDGING CO.]
President and Treasurer.

THE COMMONWEALTH OF MASSACHUSETTS,

BY JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
JOSEPH K. BAKER, } *Commissioners.*

In Council, November 18, 1885. Approved.

Witness the Seal of the Commonwealth,

[SEAL OF THE
COMMONWEALTH.]

HENRY J. COOLIDGE, *Deputy Secretary.*

[B.]

[See page 48 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS SEVENTEENTH DAY OF SEPTEMBER, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-FIVE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND FREDERICK G. WHITCOMB, OF EAST BOSTON, IN THE COUNTY OF SUFFOLK AND COMMONWEALTH AFORESAID, PARTY OF THE SECOND PART.

The said Party of the Second Part agrees with said Party of the First Part, to furnish all the materials, and build about two hundred and forty (240) feet of bulkhead, to fill the gap left in the northerly line of the present bulkhead at South Boston flats.

The bulkhead is to be built in the manner, and subject to the terms and conditions, set forth in the contract between the aforesaid parties dated September 6th, 1881, and printed in Report of Harbor and Land Commissioners for the year 1881, pages 54 & 55, and in accordance with the plan on file in the office of said Commissioners, and is to be connected at both ends with the existing bulkhead in a manner satisfactory to the said Commissioners and their Engineer. The ends of the screw bolts shall be battered sufficiently to prevent the unscrewing of the nuts.

The said Party of the First Part agrees with said Party of the Second Part, that, upon the completion of said work, it will pay said Party of the Second Part for said bulkhead, at the rate of three and $\frac{85}{100}$ dollars (\$3.85) for each lineal foot, and for each extra fastening, one and $\frac{25}{100}$ dollars (\$1.25).

IN TESTIMONY WHEREOF, the said COMMONWEALTH has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf, by its Board of Harbor and Land Commissioners, the day and year first above written, and the same

to be approved by its Governor and Council; and the said FREDERICK G. WHITCOMB has hereunto set his hand and seal, the day and year first above written.

COMMONWEALTH OF MASSACHUSETTS,

BY JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
JOSEPH K. BAKER, } *Commissioners.*

F. G. WHITCOMB.

[SEAL.]

In Council, September 23, 1885. Approved.

[SEAL OF THE
COMMONWEALTH.]HENRY B. PEIRCE, *Secretary.*

[C.]

[See page 48 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS SIXTEENTH DAY OF NOVEMBER, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-FIVE, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND JOHN P. PERKINS AND ALPHONSO P. PERKINS, COPARTNERS, BOTH OF AND DOING BUSINESS AT BOSTON, IN THE COUNTY OF SUFFOLK AND COMMONWEALTH AFORESAID, UNDER THE NAME OF JOHN P. PERKINS AND SON, PARTIES OF THE SECOND PART.

Said Parties of the Second Part hereby covenant and agree with said Party of the First Part, to furnish all the materials for, and to build about four hundred (400) feet of bulkhead, on the South Boston flats, to be located as follows: Beginning at the southerly end of the present bulkhead, on a line one hundred (100) feet easterly of and parallel with the easterly side of D Street extended; thence running southerly on said line, about four hundred (400) feet. The Plan indexed B 320, in the office of the Harbor and Land Commissioners, shows the method of construction of said bulkhead, and is to be referred to and followed in all details not specified herein.

Said bulkhead is to be built of spruce piles, driven six feet apart on centres, with two spurshores to each pile, and the piles planked from the surface of the mud to grade 13, and capped above the planks with a double girder cap each 6"×12".

The piles and spurshores are to be straight and free from large knots, and not less than ten inches in diameter at the butt, and not less than six inches in diameter at the point when ready for driving. They are to be driven ten feet into the hard bottom, and

all those injured in driving are to be removed and replaced by sound ones, at the expense of said Parties of the Second Part.

The faces of the main piles are to be brought to a true line before the planking is put on, the tops are to be cut off and capped at grade 14, and the spurshores are to be fitted, one at grade 12, and the other half way between the first and the mud, and each one is to be bolted with one $1\frac{1}{4}$ inch screw bolt.

The southerly end pile is to be braced by four spurshores instead of two, placed and fitted as directed by the Engineer.

The caps are to be spruce $6'' \times 12''$, and as long as possible, none being less than fifteen feet, and are to be fitted as shown on the plan, bolted to the piles with one inch screw bolts, and the splices bolted with $\frac{3}{4}$ inch screw bolts.

The planks are to be spruce, three inches thick, and in as long lengths as possible, none being less than twelve feet long, and the butt joints must come on the piles.

The planks are to be spiked to the piles with $\frac{3}{8}$ inch wrought iron ship spikes, six inches long.

The planking is to be still further secured by strips of spruce plank $3'' \times 6''$, well driven into the mud, and reaching to the top of the planking, and bolted through to the main piles by two $\frac{3}{4}$ inch screw bolts and one $\frac{3}{4}$ inch spike bolt.

All the timber is to be sound, sawed square, and free from large knots.

All the work is to be done in a thorough and workmanlike manner, in accordance with lines, grades, and instructions given by the Engineer of said Board, and to the satisfaction of said Board and Engineer.

The work is to be commenced without delay, and prosecuted continuously, in all suitable weather, till its completion.

Said Party of the First Part hereby covenants and agrees with said Parties of the Second Part, to pay them, for all things to be furnished and done by them as aforesaid, at the rate of three and $\frac{1}{100}$ dollars (\$3.12) per lineal foot of bulkhead.

Monthly estimates of the work done will be made by said Engineer, and payment of ninety per cent. of the contract price will be made thereon, the remaining ten per cent. to be retained until the completion, final measurement and acceptance of the work.

It is mutually agreed by the parties hereto, that, upon all questions of measurement, lines or grades, the decision of said Engineer shall be final.

IN WITNESS WHEREOF, said Party of the First Part, by its Board of Harbor and Land Commissioners, has caused these presents to be executed in its name and behalf, and to be approved by its

Governor and Council, and its seal to be hereto affixed; and said Parties of the Second Part have hereto set their hands and seals, the year and day first above written.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
JOSEPH K. BAKER, } *Commissioners.*

JOHN P. PERKINS. [SEAL.]

ALPHONSO P. PERKINS. [SEAL.]

In Council, November 25, 1885. Approved.

Witness the Seal of the Commonwealth, [SEAL OF THE COMMONWEALTH.]

HENRY B. PEIRCE, *Secretary.*

[D.]

[See page 48 of this Report, *ante*.]

AN AGREEMENT, MADE THIS EIGHTEENTH DAY OF NOVEMBER, A. D. 1885, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND THE NEW ENGLAND DREDGING COMPANY, PARTY OF THE SECOND PART.

The said Party of the Second Part hereby agrees to dredge from Bird Island Shoal, opposite the Boston and Albany Railroad docks at East Boston, at such places and to such depths as may be designated in writing by the Engineer of said Board, fifteen hundred (1,500) cubic yards of clay, more or less, and to deposit the same along the bulkheads which enclose the areas of the flats of the Commonwealth at South Boston, already filled and in process of filling, at such places, and in such quantities, and to such grades, as may be directed by said Engineer, with a view to securing and strengthening said bulkheads.

Said material shall be deposited as aforesaid, so far as it is practicable to do so, by dumping the same from dump bottom scows; and, where impracticable, by shovelling from deck scows.

Said Party of the First Part hereby agrees to pay said Party of the Second Part, for dredging and depositing as aforesaid, the following prices, to wit: The sum of twenty-five (25) cents for each cubic yard of clay so dredged and deposited from dump bottom scows, and the sum of thirty-five (35) cents for each cubic yard so dredged and deposited from deck scows, — the work to be done under the direction and supervision of said Engineer, and to the satisfaction and acceptance of said Board, and to be paid for when completed and so accepted.

The amount of material so dredged and deposited is to be determined by measurement in the scows, by or under the direction of said Engineer or his assistant.

The work is to be commenced immediately, and prosecuted with despatch until its completion.

IN WITNESS WHEREOF, the said COMMONWEALTH, acting by its Board of Harbor and Land Commissioners, has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf, and the same to be approved by its Governor and Council; and the said NEW ENGLAND DREDGING COMPANY, by Charles H. Souther, its President and Treasurer, thereunto duly authorized, has caused its corporate seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf, the day and year first above written.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
JOSEPH K. BAKER, } *Commissioners.*

NEW ENGLAND DREDGING COMPANY,

By CHARLES H. SOUTHER, [SEAL OF THE NEW ENGLAND
DREDGING CO.]
President and Treasurer.

In Council, November 25, 1885. Approved.

Witness the Seal of the Commonwealth, [SEAL OF THE
COMMONWEALTH.]
HENRY B. PEIRCE, *Secretary.*

[E.]

[See page 49 of this Report, *ante*.]

COMMONWEALTH OF MASSACHUSETTS.

HARBOR AND LAND COMMISSIONERS' OFFICE,
BOSTON, December 15, 1885.TO THE NEW YORK AND NEW ENGLAND RAILROAD COMPANY, AND
CHARLES P. CLARK, ESQ., RECEIVER :

This Board is advised that you are filling, below grade 13, portions of the "12 Acre Lot" and "50 Acre Lot," so called, purchased from the Commonwealth, and situate on the South Boston flats, with material other than that dredged from the harbor, as specified and required in the legislative acts and agreements with the Commonwealth relating to said lots. In behalf of the Commonwealth, you are hereby notified that such filling is in violation of the provisions of said acts and agreements; and you are hereby required to desist from all filling not in accordance with the same.

This notice is not intended to waive a compliance on your part with any provisions of said acts and agreements in regard to the time within which said lots were to be filled with the material therein specified.

Very respectfully yours,

JOHN E. SANFORD,	}	<i>Harbor and Land Commissioners.</i>
JOHN I. BAKER,		
JOSEPH K. BAKER,		

CHARLES P. CLARK, RECEIVER.

NEW YORK AND NEW ENGLAND RAILROAD COMPANY.

OFFICE, 244 FEDERAL STREET,
BOSTON, December 18, 1885.*Board of Harbor and Land Commissioners, Boston, Mass.*

SIRS : — Your letter of December 15th, having reference to filling on the 12 Acre Lot and 50 Acre Lot in South Boston, below grade 13, with material which was not dredged from the harbor, is received.

I presume the cause of this notice is the fact that the superintendent of the eastern division had made an arrangement with the city to fill with ashes a small portion of the 12-acre tract which remained unfilled, and that this was being done.

I have notified the superintendent to discontinue the filling under this arrangement.

Yours truly,

JAMES W. PERKINS,

Assistant to Receiver.

ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS

FOR

THE YEAR 1886.

BOSTON:

WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
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1887.

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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate and the House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submits its Annual Report for the year 1886.

BACK BAY LANDS.

All of the Back Bay lands remaining for sale at the date of the last report have been sold during the past year. The sales were as follows : —

5,824 feet on Boylston Street, north side, for . . .	\$23,296 00
5,320 feet on Marlborough Street, north side, for . . .	25,270 00
<hr/>	
11,144 feet in all, sold for	\$48,566 00

The history of the Back Bay scheme of improvement, so far as it relates to the manner in which the Commonwealth has disposed of its lands and the pecuniary results of the enterprise, may be summed up as follows : —

In 1856, the Commonwealth, after settling by agreement, exchange or otherwise the boundaries between its land and the lands of abutting proprietors, was the owner of a tract of land in the Back Bay district containing 4,723,856 square feet, or $108\frac{4}{100}$ acres.

In the lay-out of this tract, $2,027,083\frac{6}{10}$ square feet, or about 43 per cent. of the whole area, have been devoted to public avenues, streets and passage-ways.

Of the balance remaining for sale, there have been donated, or granted without consideration in money, 379,976 square feet, or about 8 per cent. of the whole area, as follows : —

	FEET.
To Massachusetts Institute of Technology,	100,898
Boston Society of Natural History,	43,840
State Board of Education, for Normal Art School,	15,568
Trinity Church,	6,193
City of Boston,	213,477
	<hr/>
Donated in all,	379,976

The cash value of the land donated as above, taken at the average price obtained per foot for all the land sold, would amount to \$833,439.36 ; and the portion received by the City of Boston, the largest donee, would be worth \$468,240.45.

The residue of the land, 2,316,796 $\frac{4}{10}$ square feet, or about 49 per cent. of the whole area, has been sold in the market for cash.

The first sale was made in 1857, and large parcels were offered and sold from time to time until March, 1872. From this date until May, 1879, — a period of depression in real estate, — sales were discontinued. They were resumed at the latter date, and were kept up until 1886, when all the land remaining was disposed of.

During the first period of selling, — from 1857 to 1872, — 1,970,739 square feet of land were sold at an average price of \$2.0035 per foot. During the last period, — from 1879 to 1886, — 346,057 $\frac{4}{10}$ square feet were sold at an average price of \$3.2752 per foot.

The average price obtained for all the land sold, from first to last, has been \$2.1934 per foot. The range of prices has run from \$1.16 $\frac{2}{3}$ to \$6.65 per foot.

From May, 1860, to April, 1879, the Commissioners were allowed by statute to sell only at public auction. Twenty-four such sales in all were had. About three-fifths of all the land sold were disposed of at these auction sales. The remaining two-fifths have been sold at private sale.

The market values of the land have risen rapidly during the last six or seven years. It is easy to see now that it

would have been better for the treasury if less land had been sold prior to 1873, and more kept for the recent advance in prices.

The cash proceeds of all the lands sold as above, — including \$2,300 received for certain rights in Parker Street, which formerly passed over the “cross-dam” in the Back Bay, — amount to \$5,084,129.42.

The cost of filling and improving the whole tract, including the expenses of auction sales, has been \$1,641,924.05. This leaves a net sum of \$3,442,205.37 which has accrued in cash to the treasury.

The cash market value of the parcels of Back Bay land which the Commonwealth, in the exercise of a large liberality, has been enabled to donate for educational and other uses, — amounting as above stated to \$833,439.36, — must be counted as a part of the net outcome of the Back Bay enterprise. The whole amount realized in cash and cash value may, therefore, be said to exceed *four and a quarter millions of dollars*.

The principal items above given may for convenience be tabulated as follows : —

In 1856, the Commonwealth owned on the Back Bay,	FEET.	4,723,856
Devoted to streets and passage-ways,	FEET.	2,027,083.60
Donated, as stated on page 6,		379,976.00
Sold in the market for cash,		2,316,796.40
		<u>4,723,856</u>
Cash proceeds of land sold,		\$5,081,829 42
Rights in Parker Street sold,		2,300 00
Total cash proceeds of sales,		<u>\$5,084,129 42</u>
Cost of filling and improving,		\$1,627,632 27
Cost of auction sales,		14,291 78
		<u>1,641,924 05</u>
Net cash proceeds of sales,		\$3,442,205 37
Cash value of land donated, at average price of land sold,		833,439 36
Total net proceeds, in cash and cash value,		<u>\$4,275,644 73</u>

It must not be inferred from what has been said that the Commonwealth has discharged itself of all further rights

and duties in respect to the Back Bay lands. Although it has sold, it has not yet conveyed all of these lands, but still holds the legal title and fee of considerable parcels, and is still bound to maintain the sewers in all the passage-ways.

The Commonwealth will also continue to sustain a peculiar relation to these lands growing out of the fact that, as grantor, it has made itself a party to the deeds of conveyance, all of which contain stipulations in the nature of restrictions upon the manner of the occupation and use of the premises conveyed. The nature and extent of the rights and remedies reserved to the Commonwealth, and of the duties assumed by it, in respect to the enforcement of these stipulations, have been discussed in previous reports, and have been considered in some of their aspects by the supreme judicial court. In the opinion of the court in the case of *Attorney General v. Williams*,* 140 Mass. 331, it is said :—

It does not, in this case, appear affirmatively that the Commonwealth has sold all of its land in the neighborhood of the premises in question, and that it has no direct pecuniary interest in enforcing the stipulations. But assuming the fact to be so, it still has a duty to perform in this respect. Moreover, it may be said to have constituted itself a trustee for all the parties in interest, by the form of the stipulation, with the implied assent of each grantee who takes a deed containing it. In either aspect, it has such an interest and duty as to entitle it, by its proper officer, to sue in this court, on behalf of the rights and interests of those who claim its protection.

SOUTH BOSTON FLATS.

A map of that section of the South Boston Flats which lies between Fort Point Channel and E Street extended to the main channel of the harbor, is appended to this report. The map is specially intended to exhibit the location and surroundings of the area (shaded on the plan) of $99\frac{46}{100}$ acres now under improvement by the Commonwealth, and the manner in which this tract, in connection with the contiguous territory, may be laid out. The distance of the tract from the centre of the city of Boston—taking the Post-office as the central point—is one mile. The details of the plan, in respect to the lay-out of cross streets, docks and piers, are

* See Appendix to this Report, page 72.

held subject to such modification as the uses for which the property is demanded may hereafter seem to require.

Progress of the Work.

There have been deposited upon the above-described area of $99\frac{46}{100}$ acres, during the last year, 184,131 cubic yards of material, equivalent, when levelled, to $10\frac{9}{100}$ acres completed to grade 13, and making, with the work previously done, an equivalent of $92\frac{7}{10}$ acres in all completed to that grade.

A small section of this area has been for several years in process of filling, at a low cost, with ashes and other suitable refuse material, deposited from carts by the city of Boston and other parties. The bulk of the last year's work was done under two contracts with the New England Dredging Company.

Contract No. 1, which provided for the filling of a specified section with material required to be first dredged by the contractor from shoals in the harbor, was satisfactorily completed early in the year; and no new contract of this character has yet been made with the same or another party.

Contract No. 2 provides for the receiving and depositing by the contractor, upon another specified section, of all such proper material, dredged by other parties, as may be brought, without expense to the Commonwealth or the contractor, to the dumping station on the Flats provided by the contractor for its reception. Work under this contract has continued through the year, as material was supplied; and the contract has been extended to cover the present year. The cost of filling, under this contract, is about one-half of the cost under contract No. 1.

The quantity of dredged material offered the last year was comparatively small, owing to the want of large outside contracts for dredging. The contemplated work of the national government in deepening and widening the harbor channels, for which an appropriation was made by Congress last August, is likely to increase the amount offered the present year. The supply from this and other sources will probably be sufficient, and may be more than sufficient, to complete

the filling to grade 13 of the whole area now under improvement.

The New York and New England Railroad Company has not as yet completed the filling of the adjacent territory in the manner, nor within the time, required by the agreements of purchase from the Commonwealth. The chief engineer of the company reports that there have been deposited during the last year, on the "50-acre lot" about 12,000 cubic yards, and on the "12-acre lot" about 9,000 cubic yards, of gravel and refuse material, below grade 13. By the strict terms of the agreements, the material so deposited should have been dredged from the harbor; but the railroad company, by way of compensation or equivalent, and by arrangement with this Board, has delivered at the dumping station on the Flats 36,597 cubic yards, scow measurement, equal to 28,152 cubic yards measured in the fill, of dredged material, which has been utilized in filling the Commonwealth's flats below grade 13.

Drainage.

To provide for the drainage of B, C and D Streets and the interlying territory, — a level area which contains about 105 acres, and includes nearly all of the tract now under improvement, — a careful study has been made, resulting in a plan for the construction of a brick main sewer in C Street, with connecting pipe sewers in the intersecting streets, the main sewer to discharge into the city sewer in First Street, and the system to be of sufficient capacity and of proper grade to serve all the present and future requirements of the territory in question.

The work of sewer construction can be done with greater ease and economy before the streets are gravelled up to the final grade 16. During the last season 1,391½ feet of 36 x 50-inch brick main sewer were built in C Street, beginning at the junction with the city sewer in First Street, and 2,722 feet of connecting pipe sewers were laid in the intersecting streets, with man-holes and connecting catch-basins, all of the most approved construction, and in conformity with the general system adopted.

The appended map (before referred to) indicates the loca-

tion of the lines of sewer already laid. The system will be gradually extended, to be followed by the gravelling of the streets in which the sewer work has been completed.

The several contracts and agreements entered into in respect to this and other work on the Flats, will be found in the Appendix.

Provision for Continuing the Work.

The balance in the "Commonwealth's Flats Improvement Fund" on the first day of January, 1886, available for carrying on the work, was \$90,045.30; to which there have been added during the year, \$5,544.16 from rents and income of the fund, and \$75,000 paid into the fund from the treasury of the Commonwealth under the provisions of chapter 46 of the Resolves of 1886; making a total of \$170,589.46 available for the work. Of this sum there has been expended during the year \$131,590.65, leaving an available balance, January 1, 1887, of \$38,998.81. In order to provide for the continuance of the work upon the area now under treatment, and for utilizing the material for filling likely to be offered the coming season, it is estimated that it will be necessary to make provision for the payment of \$75,000 into the fund the present year.

Reserved Channel.

A "reserved channel" was a strongly approved feature of the original scheme for the reclamation and improvement of the Flats, but was stricken out of the plan by a resolve of the General Court in 1877, and again restored as a permissible feature by chapter 46 of the Resolves of 1886. Such a channel would seem to be of great and unquestionable advantage to the owners of the South Boston shore eastward from E Street; and, if their co-operation can be secured on fair and reasonable terms, its adoption will, in the present aspects of the general scheme of improvement, be found to be probably desirable in the interests of the Commonwealth. It has already been the subject of conference with interested parties, and is likely soon to receive further and more definite consideration.

BOSTON HARBOR.

The Back Bay Enterprise, the first of the great schemes of improvement already spoken of, was a scheme of *land* improvement. The reclamation of the South Boston Flats was, on the contrary, in its first conception a scheme of *harbor* improvement; and this idea has been kept steadily in view in the plan and execution of the work.

It was rightly expected that the South Boston enterprise would yield from time to time a full return for the money laid out upon it. It is believed that it will continue to do so. The primary purpose in walling and filling the flats was not, however, to create valuable land for the market, but to preserve and improve the channels of Boston Harbor by giving a right direction to its tidal currents, while at the same time a largely increased deep-water frontage should be added to its commercial facilities.

A double object was also involved in that feature of the plan by which the material for filling the flats was to be obtained by dredging from the channels and shoals of the harbor itself, and the capacity of the harbor for deep-draught vessels thus increased, while the material removed was well utilized.

It is gratifying to be able to state that, apart from and in addition to the improvements made from time to time by the national government in Boston Harbor, the Commonwealth, in pursuance of the arrangement just indicated, has added nearly 100 acres to the deep-water area of the upper harbor, by dredging to the depth of 23 feet at mean low water for the material deposited on the flats. A large amount of material dredged by the national government and private parties has been utilized in like manner, and not only saved from waste, but from probable injury to the harbor by dumping elsewhere.

During the last year, a portion of Junction Shoal, at the mouth of Charles River, has been removed by the Commonwealth, the cost of removal being paid from the income of the compensation fund for Boston Harbor. The portion of the shoal removed extended from near the Chelsea Ferry landing to near Atkin's Wharf, and contained an area of

about 344,600 square feet (nearly 5 acres), all of which was dredged to the depth of 23 feet at mean low water. The material removed, about 32,500 cubic yards, was deposited on the flats at South Boston.

An appropriation of \$56,250 for Boston Harbor was made by Congress at its last session, and an interesting statement of the improvements in progress and in contemplation, kindly furnished by Lieut. Col. George L. Gillespie, U. S. Engineer in charge, will be found on a subsequent page.

GLOUCESTER HARBOR.

In view of the growing importance of this harbor, a thorough resurvey of the frontage and wharf lines of the inner harbor was begun, and more than half completed, in 1885. It was expected that this survey would be completed in time to enable the Board to recommend to the legislature at its present session a carefully revised harbor line; but the pressure of other work upon the Engineer and his assistants has prevented.

During the last season, the field work of the survey of all the frontage covered by the harbor line of 1866, except Ten Pound Island and a short section of Pavilion Beach, has been finished, and the field sheets are now being transferred to one office sheet, for the purpose of laying down and fixing the position of the harbor line for alteration and restatement, so far as may seem necessary.

The proper fixing of a portion of this line may require the taking of some soundings, which cannot be done before the coming spring, when it is also intended to complete the topography by the survey of Ten Pound Island and Pavilion Beach. A general hydrographic survey of the inner harbor is also contemplated.

After the position of the harbor line is determined, it will require to be surveyed and connected with the various bounds and reference points already established, so that an accurate description may be made.

This harbor is also under survey by the national government, but in a manner and for purposes quite unlike the above.

ROWLEY RIVER RAILROAD BRIDGE.

The Railroad Commissioners and Harbor and Land Commissioners, sitting as a joint commission, were instructed, by chapter 261 of the Acts of 1886, to hear, after due notice, all persons interested in the maintenance of a draw in the bridge of the Eastern Railroad Company over Rowley River, and were empowered to authorize such action by the railroad company in respect to the repair or reconstruction of the bridge as the public interests might demand, including, if it should seem desirable, the closing of the draw.

At a hearing held pursuant to the statute, it appeared that there was no present navigation of the river at and above the bridge by masted vessels; that substantially its only use at that point was for the transportation of salt or meadow hay in scows or barges; and that the railroad company desired to build a new bridge without a draw, but of such span and height as to better accommodate the passage of hay craft than the present bridge.

Under these circumstances, there did not seem to be a present need of a draw, and such need was not urged upon the Commission. The railroad company was accordingly authorized to build a new bridge without a draw, in accordance with a plan approved for that purpose, but subject to the right of the general court to require a draw at any future time. The formal adjudication of the joint commission will be found in the Appendix.

FIELD AND OFFICE WORK.

Miscellaneous Surveys.

More time than usual was spent by the Engineer and his assistants, during the first four months in the year, in connection with the improvement of the South Boston Flats, in giving the lines, grades and instructions required by the closing up of contract No. 1 with the New England Dredging Company for dredging and filling, and in connection with contract No. 2 with the same company for filling, which latter work has continued through the year.

In April, May and June, lines and grades were given for the removal by dredging of a portion of Junction Shoal at the mouth of Charles River, and a survey of the area dredged over was made upon the completion of the work.

In July, surveys and plans were made for a system of streets and sewers to drain the filled land on South Boston Flats, and the construction of the sewers required constant attention during the rest of the year, in giving the necessary lines and grades, and in making monthly estimates of the work done.

In November, the survey of the frontage and wharf lines of Gloucester Harbor was continued, and the topography executed from Duncan's Point to the Pavilion Hotel.

Licenses Granted and Plans Approved for the Erection of Structures in and over Tide Waters.

About the same number of applications for licenses for wharves and other structures in and over the tide waters of the Commonwealth, and for the approval of plans for structures authorized by the Legislature, has been made the past year as in previous years, as is shown by the list hereto appended:—

Nos.

908. Petition of Dexter J. Cutter for license to extend and enlarge his wharf by filling two parcels of flats, and by building a coal run on piles, in Mill Creek, Dorchester District, city of Boston. Granted January 7, 1886.
909. Petition of Eugene V. R. Thayer for license to build a pile pier near Paine's Head, in the town of Beverly. Granted January 28, 1886.
910. Petition of Thomas R. B. Edmands and Charles Collier for license to extend their wharf on Mystic River, Charlestown District, city of Boston. Granted February 11, 1886.
911. Petition of the Onset Bay Grove Association for license to build a bridge over Swift's Narrows, Onset Bay, in the town of Wareham. Granted February 11, 1886.
912. Petition of the city of Boston for license to dump into tide waters from the several bridges in and around said city, and from the wharves owned by said city, snow and ice collected from the streets and public places of said city. Granted February 11, 1886.

913. Petition of the County Commissioners of Bristol County for approval of plans for the construction of a bridge across Lee's River, in the towns of Somerset and Swanzey, as authorized by chapter 166 of the Acts of 1877, amended by chapter 69 of the Acts of 1885. Approved February 11, 1886.
914. Petition of John J. Cook for license to build a pile wharf in Provincetown Harbor. Granted February 25, 1886.
915. Petition of Obadiah Snow for license to build a pile wharf in Provincetown Harbor. Granted February 25, 1886.
916. Petition of Isaac H. Higgins and Asa T. Gifford for license to extend their wharf on piles in Gloucester Harbor. Granted March 11, 1886.
917. Petition of Oliver Ditson and Company for license to construct a solid wharf in Fort Point Channel in the city of Boston. Granted March 11, 1886.
918. Petition of the Bay State Gas Company for license to construct a solid wharf in Dorchester Bay in the city of Boston. Granted March 11, 1886.
919. Petition of the National Dock and Warehouse Company for license to extend its wharf in East Boston. Granted March 11, 1886.
920. Petition of the city of Salem for license to construct a pile and plank sewer at or near Palmer's Cove in the city of Salem. Granted March 18, 1886.
922. Petition of the Dole Fertilizer Company for license to construct a wharf at Spectacle Island in Boston Harbor. Granted March 25, 1886.
923. Petition of the city of Haverhill for license to construct a main sewer in the bed of Little River in said city. Granted April 1, 1886.
924. Petition of the Adamanta Manufacturing Company for license to construct a pile and timber wharf in Salem Harbor. Granted April 15, 1886.
925. Petition of Orlando F. Belcher and John B. Huckins for license to construct a wharf, partly solid and partly on piles, at Winthrop in Boston Harbor. Granted April 15, 1886.
926. Petition of George Lawley & Son for license to build a wharf and breakwater and to dredge a basin near O Street in South Boston. Granted April 22, 1886.
927. Petition of Lucy M. McKenzie and others for license to extend their wharf in Harbor Cove in the city of Gloucester. Granted April 22, 1886.

928. Petition of Mary L. Dorr for license to construct a solid wharf in Buzzard's Bay in the town of Wareham. Granted April 22, 1886.
929. Petition of the Bay View Pavilion Company for license to construct a pile structure at Clark's Cove in the city of New Bedford. Granted May 6, 1886.
930. Petition of David G. Allen for license to build a pile wharf in Harbor Cove in the city of Gloucester. Granted April 29, 1886.
931. Petition of the Board of Park Commissioners of the city of Boston for approval of plans for building a sea-wall and doing certain filling in Charles River in said city, as authorized by chapter 134 of the Acts of 1886. Approved April 29, 1886.
932. Petition of the Eastern Railroad Company for license to construct a new draw in its bridge over North River in the town of Beverly. Granted May 6, 1886.
933. Petition of Amos F. Bennett for license to enlarge his wharf in the town of Manchester. Granted May 20, 1886.
934. Petition of Mrs. Lamont G. Burnham for license to construct a pile wharf at Long Island in Essex River in the town of Essex. Granted May 20, 1886.
935. Petition of John Pickett for license to extend his two wharves in Beverly Harbor in the town of Beverly. Granted May 27, 1886.
936. Petition of the Commissioners of the West Boston, Canal, and Prison Point Bridges for license to do certain work in the repairs of the Canal Bridge across Charles River, between the cities of Boston and Cambridge. Granted June 10, 1886.
937. Petition of George M. Wonson for license to extend his wharf in Smith's Cove in the city of Gloucester. Granted December 2, 1886.
938. Petition of Hamilton and Balcomb for license to fill solid the easterly dock of their wharf on South River in the city of Salem. Granted June 10, 1886.
939. Petition of Allen, Slade and Company for license to construct a pile wharf in Mount Hope Bay in the city of Fall River. Granted June 16, 1886.
940. Petition of Nathaniel J. Rust and Henry W. Foote for license to construct a floating stage in Kettle Cove at Magnolia in the city of Gloucester. Granted June 24, 1886.

18 HARBOR AND LAND COMMISSIONERS. [Jan.

941. Petition of Mrs. A. T. Williams for license to construct a pile wharf in Provincetown Harbor. Granted July 8, 1886.
942. Petition of James Mears for license to construct a pile wharf in Quincy Bay in the town of Quincy. Granted July 15, 1886.
943. Petition of Samuel Cabot for license to build and extend a wharf on Chelsea Creek in the city of Chelsea. Granted July 15, 1886.
944. Petition of George L. Damon for license to construct a solid wharf, and a pile platform in front of the same, on Charles River in the city of Cambridge. Granted July 15, 1886.
945. Petition of Azariah F. Crowell and Isaiah Spindel for license to maintain the present Bar Neck Wharf, and to construct an addition thereto, at Wood's Holl in the town of Falmouth. Granted July 22, 1886.
946. Petition of Edward P. Shaw for license to construct a pile wharf at the north-easterly end of Plum Island in Merrimack River in the city of Newburyport. Granted July 22, 1886.
947. Petition of Nathaniel J. Rust and Henry W. Foote for license to fill solid a portion of a pile wharf in Kettle Cove at Magnolia in the city of Gloucester. Granted July 22, 1886.
948. Petition of William Minot, Jr., for license to construct a stone wharf and breakwater in Buzzard's Bay in the town of Wareham. Granted July 29, 1886.
949. Petition of William B. Lambert for license to construct a temporary pier and float in Hingham Bay in the town of Hull. Granted July 29, 1886.
950. Petition of J. H. and F. A. Langmaid for license to construct a sea-wall and fill solid a dock in South River in the city of Salem. Granted August 12, 1886.
951. Petition of the city of Boston for license to build a pile wharf on the south-easterly side of Long Island in Boston Harbor. Granted August 18, 1886.
952. Petition of Azariah Crowell and Isaiah Spindel for license to extend Bar Neck Wharf at Wood's Holl in the town of Falmouth. Granted September 23, 1886.
953. Petition of Charles Tobey for license to construct a pile wharf in Barnstable Bay in the town of Dennis. Granted September 2, 1886.

954. Petition of the city of Boston for license to construct East Ninth Street in and over tide water between Old Harbor and H Streets in South Boston. Granted September 9, 1886.
955. Petition of the Dole Fertilizer Company for license to construct a pile wharf at Spectacle Island in Boston Harbor. Granted September 9, 1886.
956. Petition of Augustus B. Martin for license to construct a wharf, partly solid and partly on piles, in Lynn Harbor. Granted September 9, 1886.
957. Petition of the Bradley Fertilizer Company for license to extend its wharf on piles in Weymouth Back River in the town of Weymouth. Granted September 16, 1886.
958. Petition of the city of Boston for license to construct East First and Q Streets in and over tide water at South Boston Point. Granted September 30, 1886.
959. Petition of Houghton, Mifflin and Company for license to build a sea wall and fill solid the area enclosed by the same in Charles River in the city of Cambridge. Granted September 30, 1886.
- 960, 960^a. Petition of the city of Salem and town of Beverly for license to construct a pile and timber sidewalk on the easterly side of Essex Bridge in said city and town. Granted October 21, 1886.
961. Petition of the town of Westport for license to reconstruct and widen its stone highway bridge over Acoaxet River in said town. Granted October 7, 1886.
962. Petition of Reed and Gamage for license to extend their wharf at Smith's Cove in the city of Gloucester. Granted November 18, 1886.
963. Petition of the city of Boston for license to construct Bennington Street in and over tide water from Trumbull Street to Saratoga Street in East Boston. Granted December 2, 1886.
964. Petition of the Boston, Winthrop and Shore Railroad Company for license to fill solid a portion of its pile bridge across Belle Isle Creek in the city of Boston and town of Winthrop. Granted December 9, 1886.
965. Petition of the town of Medford for license to change the course of Gravelly Brook between Water Street and Mystic River in said town, and to construct an artificial channel and gates therefor. Granted December 9, 1886.

966. Petition of the Boston and Lowell Railroad corporation for license to widen its existing passenger bridge across Charles River, and to extend its wharf adjacent thereto in the city of Cambridge. Granted December 9, 1886.
967. Petition of the Metropolitan Railroad Company for license to dump snow and ice from certain bridges into Boston Harbor. Granted December 9, 1886.
968. Petition of the South Boston Railroad Company for license to dump snow and ice from certain bridges into Boston Harbor. Granted December 9, 1886.
969. Petition of D. D. Kelly and Son for license to construct a pile wharf in Boston Harbor at East Boston. Granted December 16, 1886.
971. Petition of the city of Boston for license to dump snow and ice from certain bridges into Boston Harbor. Granted December 16, 1886.
972. Petition of the Boston Consolidated Street Railway Company for license to dump snow and ice from certain bridges into Boston Harbor. Granted December 16, 1886.
973. Petition of the Producers' Marble Company for license to dump snow and ice from Charles River Bridge into Boston Harbor. Granted December 16, 1886.
974. Petition of Joan E. Swift for license to construct a solid wharf in Wood's Holl Great Harbor in the town of Falmouth. Granted December 23, 1886.
975. Petition of the city of Malden for license to change the course of Spot Pond Brook in said city, and to construct an artificial walled channel therefor, and to fill the lands and flats adjacent thereto. Granted December 23, 1886.

HARBOR IMPROVEMENTS BY THE UNITED STATES.

The Board is indebted to the courtesy of the officers of the United States Corps of Engineers for valuable and interesting reports on the works of improvement in the rivers and harbors of the Commonwealth under their respective supervision during the last year.

The charge of the rivers and harbors on the Eastern section of the coast of Massachusetts, was assigned early in the year by the United States Engineer Department to Lieut. Col. George L. Gillespie, as successor to Major Charles W.

Raymond, with headquarters in Boston; and Lieut. Col. George H. Elliot has continued in charge of the rivers and harbors on the Southern section of the coast, with headquarters at Newport. To each of these officers the public is indebted for able and efficient service.

Improvements on the Eastern Coast of Massachusetts.

Lieut. Col. George L. Gillespie has kindly furnished the following concise and comprehensive statement of the work done in the rivers and harbors under his charge, including the harbor of Boston, during the year 1886: —

UNITED STATES ENGINEER OFFICE,
BOSTON, MASS., Jan. 7, 1887.

The Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN:— In accordance with your request of the 21st ultimo, I have the honor to furnish the following brief statement of the work done during the past year by the general government in those rivers and harbors of Massachusetts that are under my charge: —

I. Newburyport Harbor.

The sand-catch in rear of the south jetty was repaired and rebuilt with an enlarged cross section, for a total length, including spurs, of 860 feet. As rebuilt it consists of a strong timber frame partly sunk in the sand, filled with brush and loaded with stone.

The appropriation of \$37,500, made by Congress in the Act of August 5, 1886, for this harbor, will be expended in extending the full section of the north jetty. A contract for this purpose has been executed with Mr. Charles H. Edwards. It calls for the deposit of 15,000 tons of rubble-stone. This, it is estimated, will extend the full section of the jetty about 300 feet. Under this contract, during the months of November and December, 1886, the contractor deposited 1,401 tons of stone.

The improvement of this harbor contemplates the erection of a permanent entrance channel 1,000 feet wide and at least 17 feet deep, at mean low water. This is to be effected by building two converging rubble-stone jetties from the beaches north and south of the entrance. These jetties finally become parallel 1,000 feet apart, and are to be extended out, towards the bar, so far as may be necessary to produce the desired effect. It is also designed to protect the beaches near the jetties, if necessary to prevent wear, and to close Plum Island basin to prevent the formation of a harbor entrance through it.

At present the north jetty is 1,540 feet long of its full section, and it extends 1,100 feet farther out with a partially submerged section. The south jetty is 1,077 feet long of its full section, and its partially submerged section extends 223 feet farther. The outer ends of the jetties are now 1,320 feet apart, and have commenced to assume their parallel direction.

The only beach protection so far found to be necessary, has been effected by the construction of the sand-catch in rear of the south jetty. The beaches outside of the jetties have increased, and the wear inside of the jetties has apparently stopped.

The dike closing Plum Island basin is in good order, and has retained very large quantities of sand.

A survey of the harbor entrance, made in June last, showed that there was a channel over the bar with a minimum width of 200 feet, and a depth of 12 feet at mean low water. The original depth of water was but 7 feet. This increase of depth is most encouraging for the ultimate success of the improvement.

2. *Harbor of Refuge, Sandy Bay, Rockport.*

The design here is to create a national harbor of refuge of the first class, by the construction of a breakwater. No definite project has been adopted except for the formation of a rubble mound which will support the superstructure.

During the year, 112,597 tons of rubble-stone have been deposited along the axis of the breakwater, making a total, since the commencement of work, of 115,352 tons. About 1,480 running feet of the sub-structure of the breakwater have been essentially completed.

The appropriation of \$100,000 for this work, made by the Act of August 5, 1886, will be expended in the extension of this sub-structure. A contract for 126,000 tons of rubble-stone has been executed with the Rockport and Pigeon Hill Granite Companies, under which they will commence work as soon as the present contract is completed. It is estimated that this amount of stone will complete about 500 feet of the sub-structure.

3. *Gloucester Harbor.*

By the Act of August 5, 1886, Congress appropriated \$5,000 for this harbor, of which \$2,000 were to be expended for a survey, and the balance on Babson's ledge. The survey was partly made during the latter part of the year. Field operations were stopped by extremely unfavorable weather early in December. The whole of the inner harbor has been closely covered with soundings and borings.

4. Manchester Harbor.

An estimate for a survey on which to base a project for the improvement of this harbor has been submitted to the Chief of Engineers.

5. Lynn Harbor.

The improvement of this harbor designs to obtain a channel through the outer and inner bars, from deep water near White Rocks to the Harbor Commissioners' line, 200 feet wide and 10 feet deep at mean low water.

The channel through the outer bar was dredged in 1884-5, and the most recent survey shows it to have remained essentially unaltered.

The channel through the inner bar was dredged at the same time, 100 feet wide and 10 feet deep. A survey made in June, 1886, showed that it was in good order, but that the cut had been injured in one or two places by vessels getting aground, and that it had filled up to the extent of about 3,000 cubic yards. This filling was anticipated and provided for in the project, which contemplates occasional dredging in this, the upper channel.

By the Act of August 5, 1886, Congress appropriated \$6,000 for continuing the improvement of this harbor. This sum, and the balance remaining from the former appropriation, will be expended in cleaning out and widening the upper channel.

A contract for this purpose was entered into on October 23, 1886, with Mr. A. R. Wright.

It is estimated that the sum available will restore the channel to the condition in which it was left in 1884, and will widen it to 150 feet, 10 feet deep at mean low water.

The contractor commenced operations early in November, 1886, and when forced to suspend operations early in December by unfavorable weather, had removed 13,700 cubic yards of sand and mud.

6. Winthrop Harbor.

An estimate for a survey on which to base a project for the improvement of this harbor has been submitted to the Chief of Engineers.

7. Boston Harbor.

Operations in this harbor have been confined mainly during the year to the repair of the sea-walls that protect it, and in surveys and studies upon which to base further improvements. The notes of the survey of 1885 have been reduced and plotted, and have

been considered in reference to the relief of the main ship channel at the "Narrows." A survey of the main ship channel at the Upper and Lower Middle has been made and the notes plotted.

Extensive repairs have been made to the sea-walls at the east head of Lovell's Island, and the south head of Deer Island; and at the middle head of Deer Island the coping and paving were repaired where necessary. Other necessary repairs to the sea-walls were prevented by the closing of the working season.

Congress, by Act of August 5, 1886, appropriated for this harbor \$56,250, of which \$18,750 were to be expended in Fort Point Channel on Part A, below Congress Street Bridge.

Under the specific allotment for Fort Point Channel, a contract was entered into with the Bay State Dredging Company on December 18, 1886, for the removal of 60,000 cubic yards from that part of the channel below Congress Street Bridge. It is estimated that this number of yards will complete the proposed channel, 175 feet wide and 23 feet deep at mean low water, from deep water to the drawbridge. The contractor commenced operations December 20, and during the month removed 12,324 cubic yards. Any further improvement of the channel, above Congress Street Bridge, is subject to the contingency of additional appropriations and the alteration of the draw piers of the New York and New England Railroad, which rests on piles driven but 19 feet below mean low water.

About \$13,000 of the appropriation will be required for repairs to the sea-walls. This leaves available for the improvement of the harbor about \$24,000.

This sum it is proposed to expend in widening the main ship channel at the upper end of the Lower Middle, and in removing a dangerous spur from the south-east point of Lovell's Island in the "Narrows."

8. Hingham Harbor.

Six thousand dollars were appropriated for this harbor by the Act of August 5, 1886.

On November 10, 1886, a contract was entered into with Messrs. Boynton Bros. for the dredging of about 1,000 yards of material, and the blasting of about 150 cubic yards of ledge. This will improve the main ship channel, at a point about 1,600 feet north-east of the steamboat wharf, so that 10 feet of water will be obtained in a cut 50 feet wide, over a ledge in this part of the channel. During the month of November, the contractors removed 1,247 cubic yards of sand and gravel, thus completing the proposed dredging. On December 30, they were authorized to suspend

operations until early spring, for the preparation of their blasting plant, and to obtain more favorable working weather.

9. *Scituate Harbor.*

The Act of August 5, 1886, appropriated \$10,000 for this harbor.

On October 23, 1886, a contract was made with Mr. H. W. Phillips for the removal of "Harbor Rocks." During the month of November he completed the work by the removal of about 65 cubic yards of bowlders, inclusive of a large bowlder in the main channel, called "Channel Rock."

On October 26, 1886, a contract was executed with Messrs. Boynton Bros. for dredging 20,000 cubic yards of material from the harbor. This will enlarge the anchorage area, concentric, approximately, with the "Deep Hole," to a basin of about 400 by 550 feet in plan, 7 feet deep at mean low water. The contractors commenced work in November, 1886, and at the close of the year had removed 8,901 cubic yards of sand and mud.

10. *Duxbury Harbor.*

An estimate for a survey on which to base a project for the improvement of this harbor has been submitted to the Chief of Engineers.

11. *Plymouth Harbor.*

The breaks in Long Beach, caused by the gale of December, 1885, were closed, so soon as the season permitted, by substantial timber and brush bulkheads, aggregating, with spurs, about 800 feet. No damage to the beach has since occurred, and this vital part of the harbor remains in good order.

Six thousand dollars were appropriated for this harbor by the Act of August 5, 1886. This sum it is proposed to expend in widening the dredged channel, and extending it through the "Basin" to the town wharves. A contract for this work was executed October 22, 1886, with the New England Dredging Company. It calls for the removal of 20,000 cubic yards, and work under it will be commenced early in the spring.

A survey made in November, 1886, showed that the dredged channel has steadily improved in width and depth, and between the 9 feet contours it averages 100 feet wide; but that the basin has shoaled, and is about 3 feet deep at its upper end, and $7\frac{1}{2}$ feet at its junction with the channel. Over about one-third of its area it averages $6\frac{1}{2}$ feet depth, and the remainder has about 5 feet depth.

12. Wellfleet Harbor.

An estimate for a survey on which to base a project for the improvement of this harbor has been submitted to the Chief of Engineers.

13. Provincetown Harbor.

The Act of August 5, 1886, appropriated \$3,000 for this harbor. Part of this sum has been expended in repairing and extending the sand-catches near Abel's Hill dike, and in completing the survey of the House Point Island flats that was commenced in 1885. This survey is calculated to enable a definite project to be prepared, by which to arrest the encroachment of these flats on the harbor.

All of the beach protections surrounding this harbor are in good order.

14. Ipswich River.

The general project for the improvement of this river proposes a channel 60 feet wide and 4 feet deep at mean low water, from the mouth to the town wharves. It is proposed to expend the sum of \$2,500 appropriated by the Act of August 5, 1886, for this river, in cutting a channel of the above dimensions through the "Shoals" and "Labor in Vain." A contract for this purpose was made with Mr. Thomas Symonds on November 8, 1886. It calls for the dredging of 7,000 cubic yards, and under it operations will be commenced early in the spring.

15. Merrimac River.

No work has been done in this river during the year, as there were no funds available. The improvement of the river from its mouth to the head of the "Upper Falls" so far executed, has obtained the following depths of water, at ordinary river stages:— From the mouth to Deer Island bridge, $16\frac{1}{2}$ feet; from Deer Island bridge to Haverhill bridge, 12 feet; thence to the foot of Mitchell's Falls, 10 feet; thence to the head of the Upper Falls, not less than $4\frac{1}{2}$ feet, when the mill water at Lawrence is running.

Certain additional improvements are needed in the lower river. Small shoals and rocks should be removed in the falls above Haverhill, and the "Boilers" should be blasted to at least 5 feet depth.

In the upper river, above Upper Falls, if Gages and Andover bars, and a few detached bowlders and ledges were removed, the

same depth of water could be carried to Lawrence, as now exists through Mitchell's Falls.

Any additional appropriations that may be made will probably be expended for these improvements.

16. Malden River.

No work was done during the year, as no funds were available. The improved channel remains in good order. It has a least width of 50 feet (70 feet at turns) with 12 feet depth at mean high water.

17. Charles River.

No work was done during the year. The improved channel remains in good order. From the mouth of the river up to Western Avenue bridge ($4\frac{3}{4}$ miles), it has a minimum depth of 7 feet, with 200 feet width; thence to Arsenal Street bridge ($2\frac{1}{2}$ miles), it is 80 feet wide and 6 feet deep. Work was stopped at this point for the reason that the draws and piers of this bridge do not conform to the projected channel above it.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col. of Engineers, U. S. Army.

Improvements on the Southern Coast of Massachusetts.

By the courtesy of Lieut. Col. George H. Elliot, the Board has received an advance copy of his report to the Chief of Engineers of work done in the rivers and harbors under his charge during the fiscal year ending June 30, 1886, from which the following extracts are taken: —

Hyannis Harbor.

In the years 1827–38, a breakwater of riprap granite 1,170 feet long was constructed, covering an anchorage of about 175 acres, the entrance to which has a depth of about $15\frac{1}{2}$ feet. It was not as strongly built as we would now build a breakwater in a locality of like exposure, and, in the years 1852–82, extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top.

The depth of water inside the breakwater is insufficient for many vessels that seek the harbor for refuge, and the river and harbor

act of July 5, 1884, provided for a preliminary examination and survey of the harbor, with a view of deepening it. . . . The commencement of this work has been approved by Congress making an appropriation of \$10,000 therefor in the act of August 5, 1886.

No work has been in progress during the last fiscal year. . . . The execution of the project before referred to, of deepening the anchorage area inside the breakwater, will be commenced at the eastern end of the anchorage, and the full width of the area proposed to be deepened will be carried to the westward as far as the appropriation of August 5, 1886, will allow. Amount available for fiscal year ending June 30, 1887, \$10,080.81.

Nantucket Harbor.

Before the commencement of the present works, there was a shoal about $1\frac{1}{2}$ miles in width outside the entrance, through which shoal the channel or line of best water was only about 6 feet deep, and very crooked, and subject to changes in location.

The present approved project is to construct jetties of riprap stone, projecting from either side of the present entrance to the harbor, for the purpose of concentrating the strength of the tidal currents, and excavating a channel of 15 feet depth by scour, and, at the places where the full depth required will not be reached by this means, to complete the work by dredging. . . .

The amount expended on this project up to the close of the fiscal year ending June 30, 1885, including liabilities outstanding at that date, was \$100,211.25, and the result was the construction of the west jetty to a point 3,955 feet from the shore. . . .

The amount expended during the last fiscal year, including liabilities outstanding June 30, 1886, was \$5,620.87. The east jetty was commenced and fully completed to a distance of 120 feet from the initial point on the shore, which is the outer end of the middle of the three north-west spurs built on Coatue Beach some years ago, and the foundation was laid and the jetty partially completed for an additional distance of 100 feet. . . .

The work required to be done to complete the existing project, is the completion of the east and west jetties, and the excavation by dredging of so much of the channel as will not be excavated by tidal scour.

It is proposed to devote the small remainder on hand July 1, 1886, and the appropriation of \$15,000 made by the act of August 5, 1886, to the extension, as far as possible, of the east jetty. Amount available for fiscal year ending June 30, 1887, \$19,167.88.

Wood's Holl Harbor.

The adopted project for the improvement of Great Harbor, Wood's Holl, was for the construction of retaining-walls on the shore, a hollow pier and wharves for the use of the United States Fish Commission, and to serve also as a coaling station for vessels of the Revenue Marine and other branches of the public service, and as a harbor of refuge. . . .

The amount expended on these works to June 30, 1885, including liabilities outstanding at that date, was \$77,842.66. The retaining and pier walls, and the dredging of the interior of the hollow pier and the berths for public vessels, had been completed, and the coal, the west, and the cross wharves had been essentially completed.

For want of funds no work has been in progress during the last fiscal year. The work required for the completion of the project . . . is the construction of the south and east wharves. In the strait of Wood's Holl there is a large and dangerous rock which is to be removed.

It is proposed to devote the small remainder on hand July 1, 1886, and the appropriation of \$14,500 made by the act of August 5, 1886, to the construction of the south and east wharves, and the removal of the dangerous rock in the strait of Wood's Holl, just referred to. Amount available for fiscal year ending June 30, 1887, \$14,546.95.

Westport Harbor.

This is a new work, and no appropriation had been made for it until, by act approved August 5, 1886, Congress appropriated \$1,000 "for sand-fence."

The late General Warren, then in charge of this district, in reporting, December 12, 1878, on the survey which he had made in accordance with section 2 of the act of June 18, 1878, stated that "the wearing of Horse Neck Point (on the north side of the entrance) could be prevented by small sand-catch jetties, and these could be gradually prolonged so as to narrow the space opposite, and increase the average depth" (of the channel); and named \$1,000 as the amount that could reasonably be expended in this way.

It is supposed, therefore, that the \$1,000 appropriated by the act of August 5, 1886, are intended for the construction of the sand-catch jetties recommended by the late General Warren; and the funds will be expended accordingly.

Wareham Harbor.

The object of the improvement is to deepen and widen the channel leading from Buzzard's Bay to Wareham. . . .

The original approved project of 1871 for the improvement, with its subsequent modifications, provides for a channel 250 feet wide and 10 feet deep at mean low water from Barney's Point down to the entrance to the harbor. Above Barney's Point the width of the channel is to be 350 feet, with the same depth — 10 feet — as below that point. The plan includes also the raising and strengthening of Long Beach, of which a large portion was submerged at low water, to carry it above the storm waves and currents and to hold it there, in order to prevent the filling of the improved channel above by material abraded from the beach. . . .

The amount expended during the last fiscal year was \$8,485.21. The channel in the upper part of the harbor in front of the wharves was carried to its full width and completed, and about one-half of the first reach below the wharves was excavated to its full depth of 10 feet below mean low water. . . .

The work required to complete the existing project, is the excavation of the channel to its full width and depth from the point to which it was carried by the last contract down to the deep water above Long Beach. There will also be required the expenditure of a few hundred dollars more in the further building up of Long Beach.

It is proposed to devote the small remainder on hand July 1, 1886, and the appropriation of \$15,000 made by the act of August 5, 1886, to carrying on the work according to the approved project as far as the funds will admit. Amount available for fiscal year ending June 30, 1887, \$15,047.46.

Taunton River.

The amount expended on the improvement of the river up to the close of the fiscal year ending June 30, 1885, including liabilities outstanding at that date, was \$134,470.44. . . .

The amount expended during the last fiscal year, including liabilities outstanding June 30, 1886, was \$2,917.95. All of the bowlders and gravel overlying the ledge at Peter's Point, within the lines of the proposed channel, have been removed; the work of blasting the ledge has been nearly completed; the major part of the broken rock has been removed by dredging, and the half-tide dam between Reuben's Island and the west shore of the river has been essentially completed.

The ruling depth of water in the river has been increased from 5 to 11 feet at mean high water, and vessels of 11 feet draught can now reach Taunton, at the head of navigation.

There remains to be done, to complete the existing project, the completion of the removal of the ledge at Peter's Point; the completion of the dredging of the channel between Berkley Bridge and Dighton, and widening and deepening at a few points above the bridge, for all of which it is hoped the funds now available will be sufficient.

It is proposed to devote the remainder on hand July 1, 1886, to the completion of the removal of the ledge at Peter's Point, and to the enlargement by dredging of the remainder of the channel between Dighton and Berkley Bridge as well as above the bridge. Amount available July 1, 1886, \$19,611.61.

MONOMOY AND ITS SHOALS.

By the courtesy of Mr. F. M. Thorn, Superintendent of the United States Coast and Geodetic Survey, the Board is enabled to present (see Appendix A) a very able and interesting report, recently made to that department by Prof. HENRY MITCHELL, concerning *Monomoy and its Shoals*, — a copy of which has, upon request, been furnished for publication in this report.

Monomoy, it need hardly be said, is the long, narrow peninsula which projects southward from the shore of the town of Chatham, at the elbow of Cape Cod, and points towards Nantucket Great Point, which, in turn, stretches northward as if to meet it. Between these two points is the easterly entrance to Nantucket and Vineyard Sounds, through which, as Professor Mitchell says, "about 30,000 vessels pass annually, and occasionally 300 in a single day." In this great highway of commerce, around Monomoy Point and between it and Great Point, lie the Shoals of which the report treats.

The purpose of the report is to show the *changes* — the shifting of position and growth in volume — of Monomoy and its Shoals during the last century. The discussion of the data available for a comparison of their former with their present location and bulk, and the methods of investigation and deduction by which the results stated are arrived at, are

fully given in the report, and are marked by the scientific knowledge, skill and acumen for which the writer of the report is distinguished.

The results are surprising, and seem to furnish just occasion for alarm. "The present aspect of the case," says Professor Mitchell, "is very threatening to navigation." It is not proposed, however, to anticipate the more full and satisfactory statements of the report itself.

A map accompanying the report of Professor Mitchell is appended to this report, and presents to the eye by distinctive colors the comparative position and dimensions of Monomoy and its Shoals as shown by a chart based upon a survey made by Capt. Paul Pinkham in 1784, the accuracy of which is vindicated by Professor Mitchell, and as shown by the United States Coast Survey chart issued in 1885.

Another map, also received with the report in question and appended to this report, shows in like manner the increase of "*Handkerchief Shoal*" between the years 1853 and 1874-75, by means of a comparison of the coast surveys made at those dates respectively.

SHORE LINES AND BEACHES OF MARTHA'S VINEYARD.

Mr. Superintendent Thorn has also kindly furnished for publication (see Appendix B) a copy of the recent report of Prof. HENRY L. WHITING on the *Changes* which have occurred during a period of forty years — 1846 to 1886 — in the *Shore Lines and Beaches of the island of Martha's Vineyard*. This report is chiefly based on a comparison of the official surveys made by Professor Whiting, as Assistant of the United States Coast and Geodetic Survey, in each of the years named.

Perhaps the most striking features which are brought to notice in this interesting paper, are the "*new opening*" through Cotamy (or Katama) Beach, and the increase in size and elevation above high water of "*Skiff's Island*."

These particular features are further discussed in a communication to this Board (see Appendix C) in which Professor Whiting speaks not so much of their physical character, as of their present and probable effects upon the material

interests of the public, and especially of those who reside in the locality and whose business is on the sea; and in which some suggestions which bear on this aspect of the case are made.

A map, which shows the changes in Cotamy Beach, and the condition of the natural or artificial openings through it in 1846 and in 1886, and at intervening dates, was received with the copy of Professor Whiting's report, and is appended to this report.

Professor Mitchell has furnished, in this same connection, a Note (see Appendix D) on the *Tidal Circulation* through Edgartown Harbor, as affected by the Inlet or opening through Cotamy Beach. The diverse tidal systems prevailing on the southern or ocean side of the beach, and at the entrance to Edgartown Harbor, respectively, and the widely different action of the tides in the harbor according as the inlet is open or closed, are clearly described; and the differing tidal velocities through the harbor, under these respective conditions, are illustrated by an appended diagram.

A vacancy in this Board was caused, in November last, by the death of Hon. Joseph K. Baker, and was subsequently filled by the appointment of Hon. Charles H. Howland as his successor.

Mr. Baker was appointed a member of this Commission in July, 1884, and had consequently served upon it between two and three years. The high estimation and regard in which he was held by his associates, in his personal as well as his official relations with them, cannot, perhaps, be better expressed than in the following minute, which, at a meeting held November 18, 1886, was adopted and entered on the records of the Board:—

Since the last regular meeting of this Board, one of its members, the HONORABLE JOSEPH K. BAKER of Dennis, has been suddenly removed by death. On Friday last, he was actively engaged with his associates in the discharge of his official duties, and was apparently in his usual health. Upon returning to his home on the evening of that day, he was stricken with the fatal illness of which he died on the following morning.

In entering this minute upon their records, his associates desire to express their high appreciation of his character and worth, and their deep sense of the loss which the public, as well as they personally, have sustained in his death. The record of his services in public and private trusts is long and honorable. He brought to his duties on this Board large experience and practical ability, sound judgment, and unquestioned integrity and fidelity. His kindly and generous qualities of heart won for him the warm regard of his associates, and the sincere respect and lasting attachment of all with whom he was brought in contact in the various relations of life. He leaves behind him the record of a useful and honored citizen, and the memory of a steadfast and valued friend.

The foregoing Report is respectfully submitted.

JOHN E. SANFORD.

JOHN I. BAKER.

CHARLES H. HOWLAND.

APPENDIX.

APPENDIX.

[A.]

[See page 31 of this Report, *ante*.]

MONOMOY AND ITS SHOALS.

BY PROF. HENRY MITCHELL.

This peninsula, and the group of Shoals about it, present dangers that affect the commerce between the States to a greater degree, perhaps, than any other obstructions; for here, at the eastern entrance to Nantucket and Vineyard Sounds, pass about 30,000 vessels annually, and, occasionally, 300 in a single day, the maximum of the year. These 300 vessels average 200 tons measurement, giving a total of 60,000 tons, and represent, with cargo, *three millions of dollars*.

These vessels not only run the gantlet among these natural dangers, but *they endanger each other* by crowding into the fairways. The principal avenue, Butler's Hole, has only half the width that it had a century ago, and its course has of late years very materially changed.

Every foot of width, where safety is assured, has a value; and, if the limits of the Shoals could be accurately defined, there would be a great reduction in the real danger, and — most of all — in the *fear of danger*, which delays the fleet in thick weather. In the measure that we can furnish the coaster with accurate charts and marks of this locality, we reduce his danger and his fears which tax the community.

The real source of trouble is the constant shifting of these Shoals, and their growth. We speak within the truth when we assert that these Shoals have doubled their volume in the last century, and that they have moved a mile in the average. The worst of it is that the movement is very far from uniform in rate or directions for different members of the group.

This neighborhood was designated by Champl  in (1605) "*Cap Batturier*," conveying the impression by this name (and the context in his narrative) of a projecting region of breaking flats. At the present rate of building, the dry land of Monomoy could scarcely

have been half the present length at the time of Champlain ; and, if half the bulk, it must have been submerged.

The present aspect of the case is very threatening to navigation. It looks as if a continuous breaker might extend from Monomoy to Nantucket on the summit of the circus that is formed by Pollock Rip, Great Round Shoal and Great Point Rip, with their connections. The present broken wall has material enough in it to close the ship navigation, if this material should be strewn along more uniformly by some great storm, so as to connect more intimately the chain of Shoals. Moreover, there is plenty of new material supplied from the caving down of the Cape Cod shore. This caving has been very active of late years, and forms the theme of reports in Appendices to the Annual Reports of the Coast Survey for 1871 and 1873. The beach in front of the town of Chatham began to break up in 1871 ; and Professor Peirce, then Superintendent, ordered special surveys, which were executed by Assistant H. L. Marindin, and formed the subject of reports by myself.

The earliest chart of this neighborhood, based upon anything like a regular survey, seems to be that of Capt. Paul Pinkham, made at the time that the present Light-house was being built upon Great Point Nantucket, in 1784. There are plenty of earlier charts, and there are sailing directions as far back as 1707 ; but the Paul Pinkham chart, on the whole, furnishes the first reliable testimony relative to the location of the Shoals at the entrance to the Vineyard Sound. I beg leave to offer an analysis of this testimony in detail, because of its importance, and because I fear that the chart of which I speak is likely, otherwise, to be confounded with a later one by the Blunts, assuming to be "Surveyed by Capt. Paul Pinkham," which is singularly out in its longitudes and in its distances.

The following appears upon the chart which I have used as my base of comparison : —

A Chart of Nantucket Shoals surveyed by Capt. Paul Pinkham.

Boston. Published and sold by Wm. Norman, No. 75 Newbury St., February 16, 1791.

To all whom it may concern :

As there never has yet been published an accurate chart of Nantucket Shoals,

These are to certify that, when the Light-house was building on Nantucket point in 1784, this survey of the Shoals was made from the lantern (an opportunity never before had for so valuable a purpose) by Capt. Paul Pinkham and others, by the help of the best compasses and instruments that could be procured ; and it has been proved by experience to be the most accurate chart ever offered to the public of those dangerous Shoals (which are a terror to all navigators), which has been run by

with greatest safety, and is fully approved; and that the publication of this chart, from its accuracy, cannot fail to be greatly beneficial to all navigators who may fall in with said Shoals, is the judgment of us, [signed by] Jno. Cartwright, Jos'h. Chase, Dan'l Coffin, Nath'l Barnard, Jas. Backer, Wm. Coffin, Alex. Coffin, Jun., Thos. Delano.

Nantucket, September 1, 1790.

The many surveyors who have attempted the survey of the Island of Nantucket, with the Shoals around it, and those charts have been published, have from experience proved very incorrect and erroneous; more particularly the Shoals which, lying at so great a distance from the land, have hitherto been laid down from information only. From hence has arisen great errors and inaccuracies in the various charts published of those Shoals.

On considering their dangerous situation, and the dread they are to all navigators who frequent the coast, as well as the great utility of a correct chart, I have been induced to use my best endeavors to obtain a new and accurate survey of the Shoals eastwardly of the Island, being taken from the Light-house on Nantucket Point in 1784, which eminence afforded a large and distant prospect of the Shoals, and from which their true bearing was had with precision and certainty. I hereby certify that the chart hereunto annexed, having been carefully examined by warrantable pilots and navigators, and run by for some years with safety, is fully approved and by them certified. [Signed by] Peleg Coffin, Jr.

Nantucket, September 1, 1790.

The scale of this chart is about 1 : 137,780. It is the property of the Nantucket Athenæum.

It will be observed from the foregoing, that the claim of accuracy particularly applies to the region seen from the Light-house, which is plotted on this old chart in latitude $41^{\circ} 22'$, longitude $70^{\circ} 00\frac{1}{2}'$. It is the same Light-house that now stands, and is found, by latest survey, in $41^{\circ} 23' 24''$ of latitude, and $70^{\circ} 02' 45''$ of longitude. The former determination, on the Paul Pinkham chart, was, then, $2\frac{1}{4}$ miles too far to the east-south-east. This error, however, need not concern us if we confine our inquiries to objects within sight of the Light-house; and, first of all, we must seek those that have not changed, in order to orient ourselves.

From Matthew Clark's chart of the neighborhood, endorsed by Osgood Carleton for the Boston Marine Society, the variation in the compass, at that time, seems to have been $6^{\circ} 45'$; and, as the Paul Pinkham chart is evidently adjusted to the magnetic meridian, we have corrected for variation (as finally ascertained to be about $6\frac{1}{2}^{\circ}$ west) in the following bearings:—

“Bishop and Clarks” Rocks, on Paul Pinkham's chart, lie $15\frac{1}{4}$

nautical miles north $39\frac{1}{4}^{\circ}$ west (true) from Great Point. Bishop and Clerks, on the most recent chart, lies $14\frac{1}{4}$ nautical miles north $39\frac{1}{4}^{\circ}$ west of Great Point Light.

The distances are measured from the old chart, not by its scale, but by minutes of latitude. I would remark here that the Paul Pinkham chart is a pretty good projection, with ratio of 1 : 1.3 for longitude and latitude divisions; but the *scale of miles* seems to be minutes of longitude.

There is, upon the north-eastern portion of Tuckernuck, a sort of lagoon, at the head of which is quite a hill, upon which there was, at the time of Paul Pinkham, and still is, a group of houses. This hill, as represented upon the Coast Survey charts, lies west 30° south from Great Point Light, distant $10\frac{3}{4}$ nautical miles. Upon Paul Pinkham's chart, the head of the lagoon bears west $29\frac{1}{2}^{\circ}$ south, distant 11 nautical miles. The lagoon is known as East Pond, and the hill that rises at its head is a very conspicuous landmark.

These three points, *Bishop and Clerks*, *Tuckernuck* and *Great Point Light*, are all that we can feel sure of as remaining unchanged.

Great Round Shoal. — If we draw a circle through the three shoalest soundings upon the Coast Survey chart, we find its centre north 55° east from the Great Point Light-house, distant $7\frac{3}{4}$ miles. On the Paul Pinkham chart, it is represented by a circular line of dots, the centre of which is north $60\frac{3}{4}^{\circ}$ east of Great Point Light, $7\frac{1}{2}$ miles distant.

Little Round Shoal. — The shoalest water lies north $39\frac{1}{2}^{\circ}$ east of Great Point Light, upon our most recent charts, distant 8 miles. Upon Paul Pinkham's chart, it is indicated by a circle of dots, the centre of which is north $40\frac{3}{4}^{\circ}$ east from the Light, distant 7 miles. This shoal is not easily distinguished from the *Stone Horse*.

"*Broken part of Pollock Rip*" lies north $37\frac{1}{2}^{\circ}$ east, $11\frac{1}{2}$ miles from the Light, on the Coast Survey chart, and north $35\frac{1}{2}^{\circ}$ east, $14\frac{7}{8}$ miles, on Paul Pinkham's chart. This is rather beyond the range of vision from the Light-house, except for a wreck, and hard to distinguish, the shoals being numerous.

Stone Horse. — The middle of this shoal, as well as can be determined, lies about in the same direction upon old and new charts, — north $22\frac{1}{4}^{\circ}$ east from Great Point Light. Its distance, according to Paul Pinkham's chart, was $8\frac{1}{2}$ nautical miles. It is now $7\frac{3}{4}$ miles; that is, the shoal has moved about three-quarters of a mile towards the Light.

Handkerchief Shoal. — This shoal has very much increased in size, and worked or extended downward. The least depth is the same ("4 feet") now as upon Clark's map of 1798; but this figure

lies about one mile further from Great Point Light on Clark's chart than upon our own. The southern point of the shoal is given $8\frac{2}{3}$ miles north 2° west from Great Point Light, by Pinkham, while by Clark it is $7\frac{1}{2}$ miles due north, and upon the recent Coast Survey chart $6\frac{1}{3}$ miles north $7\frac{3}{4}^\circ$ west. The northern or north-eastern portion of the shoal has not essentially changed, being the same for Pinkham, Clark and the Coast Survey; but the growth southward has exceeded one mile in the past century.

Upon both of the old charts (Pinkham's and Clark's), the sailing course for the "North Channel" was laid down north of the Handkerchief, and ran across what is now dry land near the present Monomoy Light.

Clark's representation of Monomoy indicates a great extent subject to overflow, so that it is difficult to make comparisons between it and other plottings.

Butler's Hole. — This most frequented channel was about $1\frac{9}{10}$ miles wide upon Pinkham's chart, one mile on Clark's, and little better than a half-mile at the time of the most recent surveys. As might have been expected, Butler's Hole has increased in depth as it has lost in width. We find nearly 20 fathoms on the site where the old charts gave 15 as the maximum depth. The present maximum depth is $23\frac{1}{2}$ fathoms.

Before entering upon the more modern history of this region, we must call attention to what we may designate as the *deep hole*, indicated by the sounding of 24 fathoms upon Paul Pinkham's chart. This sounding is plotted $7\frac{1}{2}$ nautical miles north $71\frac{3}{4}^\circ$ east of Great Point Light. Capt. McBlair, in 1849, found $21\frac{3}{4}$ fathoms at a distance of 6 miles north $79\frac{3}{4}^\circ$ east, and Capt. Brownson, at the margin of his survey of 1883, gives 20 fathoms and no bottom 7 miles north $77\frac{1}{2}^\circ$ east, of Great Point Light.

There seems to be no doubt that a *gully* of considerable extent exists, which our printed chart does not properly represent; and it is believed that this gully is a permanent feature, notwithstanding that our bearings differ from Paul Pinkham's very largely. It must be borne in mind that the bearings of *breaking shoals* could be accurately taken from Great Point Light tower; but a *deep hole* makes no sign.

This gully lies so near the proper track of the South Channel fleet, that its careful representation upon the chart would be a valuable guide to navigation; while its absence from the chart, or entirely inadequate rendering, provides for disaster. Some vessel standing in from seaward in thick weather, may happen to cast her lead in this deep place, and, believing herself outside of all the shoals, sail on to her destruction.

There is reason to believe that Great Round Shoal and this gully are to be found now just where they always have been. The sailing line on Paul Pinkham's chart of 1784, if plotted upon our own chart, lies very near the southern slope of this gully, and between it and our most recent sailing line. But why this gully should not fill up, in this region of strong tidal currents laden with sand, is a mystery. It might be worth while to take some current observations, and ascertain if a *resultant* occurs here, not elsewhere developed.

Monomoy Point. — This is well defined on Desbarres' chart of 1777, and on Pinkham's of 1791; but, on Matthew Clark's chart of 1798, it is represented as if *awash*. The distances across from Great Point to Monomoy are

1777,	On Desbarres'	Chart,	. .	14	nautical miles.
1784-91,	" Paul Pinkham's	"	. .	11 $\frac{1}{4}$	" "
1798,	" Matthew Clark's	"	. .	10 $\frac{1}{2}$	" "
1868,	" U. S. Coast Survey	"	. .	9 $\frac{1}{4}$	" "

Matthew Clark's chart only assumes to be a correction of Desbarres', while Paul Pinkham's was from a new survey.

There seems always to have been a shoal off the extreme point of Monomoy, known as "Egg Island" when dry. This shoal has sometimes attached itself to the end of Monomoy, but oftener has been separated by a deep *slough* channel. If we ignore the slough channel that now separates the point of Monomoy from the *Shovelful Shoal* (the reappearing Egg Island in an advanced position), we reduce the distance across from Great Point to less than 9 nautical miles (1875).

It should be noted here that Great Point Nantucket has lost, by fits and starts, considerable length. Paul Pinkham found the extreme point, in 1784, over 3,000 feet beyond the present Light-house, then in course of construction; Prof. Henry L. Whiting's topographical survey of 1846, gives this distance 1,900 feet; and Assistant F. D. Granger, on his hydrographic sheet of 1874, places the point (by a signal as near as possible to the high water breaker) about 1,600 feet from the Light-house. *We have every reason, then, to believe that the dry land of Monomoy has extended southward two miles during the past century.**

* There is a mysterious chart in the archives of the Coast and Geodetic Survey, entitled "A Chart of George's Bank, including Cape Cod, Nantucket, and the Shoals lying on their coasts, surveyed by Capt. Paul Pinkham," and "published by Edmund M. Blunt, 1797." This chart, ostensibly six years later than the "Chart of Nantucket Shoals" (which we found so valuable), is comparatively absurd. It is a whole degree out in longitude, and it gives for the distance from Great Point to Monomoy, sixteen minutes of latitude; and yet the bearing and distance of George's Shoal were more nearly correct than upon any previous chart. Its scale is about 1: 400,000.

The first survey of Monomoy made by a professional topographer, was that of Mr. Charles O. Boutelle, then attached to the Trigonometrical Survey of Massachusetts, in 1840. At that time the Point lay 2,681 feet south, 3,837 feet west, of the Light-house then standing.*

In 1853, Assistant S. A. Gilbert of the Coast Survey, made a plane-table survey, and found the extreme point of Monomoy 2,821 feet south, 3,542 feet west, of the old Light-house referred to by Mr. Boutelle. The first twelve to thirteen years of authentic history only advanced this point about 140 feet.

The next survey was by Assistant C. T. Iardella of the Coast Survey, in 1856, when the extreme point was found to be 3,180 feet south, 3,906 feet west, of the "old Light-house,"—showing an advance of 509 feet south-west in three years, or at the rate of 170 feet per annum.

Again, the point was located by the survey of Assistant P. C. F. West of the Coast Survey, in 1868, 4,851 feet south, 5,266 feet west, of the same "old Light-house,"—showing an advance south-westerly of about 2,123 feet in twelve years, or about 175 feet per annum.

Finally, we have the plane-table sheet of Assistant C. H. Boyd of the Coast Survey, executed with the intent to complete the history to the present time, June, 1886; and we find the point 5,266 feet south, 5,151 feet west, of the site of the old Light-house,—showing a recent advance of about $22\frac{1}{2}$ feet per annum, nearly south. The growth of the point is again slowing down; and Mr. Boyd's map shows that deposit has been arrested elsewhere *en route* from the north. It would seem that the material torn from the Chatham shore travels down the beach, or near to it, and adds itself to the point of Monomoy in unequal masses, at unequal intervals of time.

As far as we are advised, the sands move from the north, under the action of the *ground swell* which sets on from the north-east. It is the same at this entrance to Vineyard Sound, as at the entrances of Delaware and Chesapeake Bays; the *shoals protrude and advance from the north side*. Of course, at all such entrances, the flood tidal currents sweep in along the outside shores, and bear with them a great load of silt supplied by the breakers, so that the

* See Capt. Boutelle's Report, addressed to Superintendent U. S. Coast and Geodetic Survey, June 16, 1886, appended.

Capt. Boutelle's testimony against the map made by John G. Hale, in 1831, rules it out of court; but I may be allowed to state that, upon that map, the Point is represented as about 1,650 feet south of the Light, and the *Powder Hole Harbor* is absent. There is no doubt, in my own mind, that the testimony of the old people on Cape Cod is correct in ascribing the first creation of the Powder Hole to the first half of this century. We have witnessed its destruction.

resultants are towards the bay near the coast; but this movement is usually just as conspicuous on one side as on the other of the entrance.

Mr. Boyd found the Shovelful Shoal showing a dry spot for two hours at low tide. This has been dry before, but our hydrographic sheets have usually given one foot at mean low tide. The summit of this shoal is now about 2,300 feet further to the south-west than it was in 1853, but the point of Monomoy has gained upon it 877 feet. Of course, if this gain continues, a sudden annexation may be expected. It seems probable that this shoal advances more slowly than Monomoy Point, because in deeper water. The central point of the dry Shovelful is now 9,617 feet south $36^{\circ} 41'$ west (true) from the old Light-house site.*

The discrepancies of the measures of Monomoy from land surveys, cannot be attributed to any want of definition, or to differences in the height of the tide. On sandy shores exposed to ocean waves, the *strand* (that is, the belt left bare when the tide is out) is very narrow, and of nearly uniform width for tides of equal range. This is often true irrespective of the ocean depths in the neighborhood. It is quite otherwise as regards inside beaches, — those along the margins of sheltered basins or harbors, — where the strand is often broad, and always irregular, because only the continuation of the *bed-slopes*.

The point of Monomoy has always been bold, or “*steep to*,” as the sailors say.

Let us turn now from these measures of dry land to the hidden dangers that lie beneath the sea. These are *dunes*, that creep upon the track of our commerce, and grow upon the channels, to become more and more sources of distress every year; and the most remarkable of these — although not the most dangerous — is

The Handkerchief Shoal.

From a glance at our most recent survey, one would say that this shoal is shaped like a pear with stem downward. It is, in a very general sense, a sector-like figure with radius of $3\frac{1}{4}$ nautical miles and 36° *flare*. Closer examination, however, discovers that it is not symmetrical, but consists of three lobes, representing, as I think, three different periods of growth. The most northern lobe, which is the largest now, is the oldest. We find it upon Paul Pinkham's chart in the form of a horseshoe opening directly west. It was then about half the size of the present northern lobe, as

* The old Light-house was 182 feet north $46^{\circ} 30'$ west (true) from present Light-house.

limited by the 12 feet curve, or less than a third of the whole shoal as now similarly limited.

The area of this shoal, as defined by the 18 feet curve, increased from 9,888,870 square feet in 1853, to 12,636,672 in 1875; and the southern point advanced into the sound 3,400 feet, or over one-half of a nautical mile (34 seconds of latitude). The bulk of this shoal, in 1853, was 12,543,759 cubic yards; in 1875, it had increased to 19,175,835 cubic yards; and, in this interval, its centre of gravity had moved 3,956 feet south $2^{\circ} 55'$ east (true).*

It has been possible to give the above concise statement relative to the Handkerchief Shoal, because, as an isolated obstruction in the track of one of the largest fleets in the world, it has been repeatedly examined and surveyed.

I am not aware that this little chapter in the physical history of these Shoals has ever before been attempted; but I feel great confidence, having been assisted by Mr. H. F. Bothfeld, one of the best experts met with in my long professional experience.

I hope to perfect my diagnosis of this case by other papers to follow.

Very respectfully yours,

HENRY MITCHELL,

Coast and Geodetic Survey.

Report of Capt. Charles O. Boutelle concerning the earliest Topographical Survey of Monomoy.

U. S. COAST AND GEODETIC SURVEY OFFICE,
WASHINGTON, D. C., June 16, 1886.

F. M. THORN, *Superintendent U. S. Coast and Geodetic Survey, Washington, D. C.*

SIR:—I return herewith the papers submitted by Assistant Mitchell, on the subject of Monomoy Island, south of Chatham, Mass.

I recognize the smaller tracing, sent by Mr. H. F. Walling, as copied from a large manuscript map which I assisted in making. I also recognize it as a correct copy of a plane-table survey made by me of the island of Monomoy, in November, 1840. I checked the survey by several triangulation points upon the island, determined by me for temporary use, by "three-point" method.

At the time of my survey, the "Powder Hole" harbor, near the Light-house, was a place of resort for fishermen, and a harbor of refuge for small vessels.

By spacing upon the tracing, I find that the southernmost point of Monomoy Island, in November, 1840, was 2,475 feet or $24''\frac{1}{4}$

* See Sketch of Mr. H. F. Bothfeld, herewith enclosed [and appended to this Report].

south, and 3,836 feet or 50."5 *west*, of Monomoy Light. The Coast Survey position of the same light is given in Coast Survey Report for 1851, page 189, as latitude $41^{\circ} 33' 32.''79$, longitude $69^{\circ} 59' 18.''98$.

The "faint indication of a triangulation point" upon Mr. Walling's tracing, is undoubtedly that of the Light-house. He gives the squares enclosing it. These count from the zero point of the section, and are four inches upon a side, or, upon the scale of 200 rods to an inch ($1 : 39,600$), each side is 800 rods or 13,200 feet long.

In the printed tables of the Massachusetts Trigonometrical Survey, Section V, page 71, Monomoy Light-house is given as $202,380\frac{37}{100}$ feet *south*, and $191,375\frac{31}{100}$ feet *east*, of the zero point of the section. The *north* side of the square enclosing the Light is, therefore, the 15th *south* of zero, or $13,200 \times 15 = 198,000$ feet *south*; and the *east* side is also the 15th, or 198,000 feet *east* of zero.

The position of the Light-house in the square is, therefore, $4,380\frac{2}{100}$ feet *south* of its north side, and $6,624\frac{69}{100}$ feet *west* of its east side. These quantities, spaced upon the tracing, agree so closely with the triangulation point marked by Mr. Walling, as to assure its identity with the Light-house of 1840.

The necessity for my survey of Monomoy Island, arose from the grossly inaccurate character of the map of Chatham made by Mr. John G. Hale for the town authorities in 1831. This person was employed by contract with many towns in eastern Massachusetts to make maps which could be returned to the Secretary of State, under the act requiring each town to make and return a map of its territory upon an uniform scale of 100 rods to an inch. Mr. Hale's maps were all very neatly drawn, and were all very inaccurate. Many were only sketches without a survey. So far as I can recollect at this distance of time, I was informed that Mr. Hale never visited Monomoy Island, but copied some older map or chart. At any rate, the case was so flagrant an evasion of the law, that the "Selectmen" of Chatham furnished me, at their expense, with men and transportation required to make the survey.

The large tracing sent by Mr. Walling, represents Mr. Hale's map now on record in the State House at Boston.

Yours respectfully,

C. O. BOUTELLE,

Assistant C. & G. Survey.

[B.]

[See page 32 of this Report, *ante*.]

SHORE LINES AND BEACHES OF MARTHA'S VINEYARD.

BY PROF. HENRY L. WHITING.

U. S. COAST AND GEODETIC SURVEY OFFICE,
PEMBERTON SQUARE, BOSTON, MASS., September, 1886.MR. F. M. THORN, *Superintendent Coast and Geodetic Survey, Washington, D. C.*

DEAR SIR: — I present herewith a report of my recent resurveys of the shore lines and beaches of Martha's Vineyard; more particularly in regard to the changes which have occurred since the first surveys were made, just forty years ago. . . .

The changes along the southern shore of the Island, give an interesting illustration of the action of what may be termed a "rolling beach," and the power of the ocean sea-dash upon a sandy shore to drive this material before it. The south shore of Martha's Vineyard is a case where little if any other force has operated. Its geographical position, so far beyond the trend of the main-land, and its straight alignment, present an unobstructed front to the wave action.

Although in occasional storms the breakers come upon the shore in oblique directions, the prevailing action of the sea-dash is normal to the shore. Even in gales from the south-east and south-west, after the force of the wind subsides, the breakers come in directly from the south. I witnessed, some years ago, after a heavy south-east gale, a "roller," which I estimated to be a mile in length, break upon the shore with a single blow. . . .

Where the beaches have been low, particularly in front of the several ponds, the over-shot of the sands has made a greater encroachment upon the ponds and marshes inside of the beach, than occurs in the outer shore line opposite. The general recedence of the shore line I should estimate at from 175 to 200 feet. At the crest of the summit of the bluff at Nashaquitsa Cliffs, which is about 150 feet in height, the maximum waste is about 220 feet. Opposite Chilmark Pond, the maximum outer waste is about 180 feet, and the over-shot of sands into the pond, near the opening, is about 525 feet.

At Tisbury Great Pond, the outside waste, west and east of the inlet, is respectively about 180 and 140 feet; while the corresponding encroachments upon the pond, are respectively 680 and 480 feet.

Quite a peculiar coincidence occurs in the present opening into Tisbury Pond with that of 1846, which is almost identical in location and extent, except that it is further inward; while in the intervening time, — about twenty-five years ago, — the opening was about three-fourths of a mile farther eastward. Most of the inlets of the southern ponds are opened artificially, for the purpose of improving the fisheries, and to prevent the overflow of the marshes by the fresher waters of the ponds. When once opened, the width and depth of the inlets are established and maintained according to the power and condition of the tides and the wave action of the ocean. They sometimes remain open for several months, and again are closed by the first heavy storm.

The most considerable movement of the entire beach, occurs along the front of Great Herring Pond in Edgartown, where the whole mass of the beach has been driven in upon the former waters of the pond a distance about equal to twice its width. The over-shot of sands has entirely obliterated Craxtuckett Pond, and a smaller one west of Great Herring Pond; and, in one instance, changed what was a former cove into a separate pond. . . .

I had not the original map of my survey of 1846, of the eastern part of Chappaquiddick and Cape Poge, by which to make comparison of results and report upon the changes. . . . I would call attention, however, to the point of Cape Poge, where great waste has occurred. The summit of the sandy bank or bluff nearest to the Light-house, is now within about 45 feet of its foundation, and wasting rapidly. Some thirty years ago or more, the foot of this bank was protected by a riprap of stone. The line of this ridge of stone can be seen, under water, from the top of the bank, I judged from 500 to 600 feet beyond the present shore line. There is indication of overflow along the beach opposite the two easterly coves of Cape Poge Pond, which may have been of sufficient force and range to affect the outlines of the coves themselves.

How far the strong tidal currents through Muskeget Channel have affected the easterly beach of Chappaquiddick, I am unable, for the reason stated, to report. At the extreme south-easterly point of the island, — Wasque Point, — or just south and west of the point, the tendency seems to be to maintain a remarkable uniformity of position. Slight changes, forming waves in the outer line of the beach, occur with almost every storm; but the

general outline of the point is in much the same geographical position it was forty years ago.

A feature of interest and value, as a means of shelter and protection in this exposed fishing ground, is the increase, in size and elevation above high tide, of *Skiff's Island*, which, for the past twenty years, has been little more than a shoal, dry at low water. Whether its present changed condition is due to the influences of the new currents through the new opening of Cotamy Beach, is a question which would require quite elaborate observation to determine. At the time of my former survey, "Skiff's Island" was merely a shoal covered at high tide. Its condition, and the rough water and "rips" around it, made it impracticable to determine it as a topographic feature. . . . In connection with my present survey, I thought it important to determine its position and outline more accurately. . . . The Island is about south-east from Wasque Point, and distant, from shore to shore, about $1\frac{1}{2}$ miles. At the time of my recent survey, it was about 1,200 feet in length, north and south, with a greatest width, east and west, of about 290 feet, and contained an area of about $4\frac{1}{2}$ acres. Probably for the first time in the last fifty years, beach weeds and grasses are taking root and growing upon it.

The *new opening* through Cotamy Beach, so called, occurred on the night of January 9th–10th, 1886. After a gale from east-north-east, the wind shifted to west-south-west, still blowing a gale. The west beach, as the portion west of the opening is now designated, was quite low before this gale occurred, and, after the shift of wind, the whole beach, in long-shore phrase, was a "breaker." A very high tide, — one of the highest since the Minot's gale, — accompanied this storm. The general opinion is that, with the turn of the tide, the opening was first made by the outward or southerly current. As soon as the beach could be visited, the opening was already, by estimation, about 100 yards in width. On July 1, it was about 400 yards wide.

The present survey of the inlet was made on July 1; and the position of the sandy points on either side of it, as then determined, place the opening about half its width east of the position of the former opening, as determined by the survey of 1856. The width of the present inlet, as will be seen by comparison of the two surveys, is nearly the same. There is not much change in the general position of the beach, but the easterly point of the present opening is farther within the bay, northward, than at any previous time. The changes of filling up, by wind and sea, in the site of the last opening, before it closed, along its pathway between the

fast land of Chappaquiddick and the former outer beach, are exhibited by the details of the map.

Contrary to the usual action of the inlets and openings on the south side of Martha's Vineyard, and particularly those through Cotamy Beach, the resultants of the moving sands thus far, with the new inlet, have been *westward*. This, however, will probably prove to be but a temporary movement, and eventually the opening, as all previous ones have done, will work *eastward*. There are present conditions of the beach, however, which may retard this movement. This influence, if effective, will be due to the comparatively small amount of material in the west beach, which is unusually low.

One of the forces which prevail in causing the easterly movement of the opening, is the encroachment of the west point or chop upon its channel, and, by contracting it, causing a corresponding waste or cutting away on the east point or chop. Formerly, the west beach contained quite high sand hills and dunes, which supplied material for the extension of the westerly point. The high sand bank which existed in 1871, was probably one of the causes which tended to fill up the artificial cut made by General Warren.

The tidal currents through the inlet, through the narrows of Cotamy Bay, and through Edgartown Harbor, are now very strong. I am unable to state the exact velocity, but it has had power to increase the depth of water along the front of the town, and about the wharves. The currents are also effecting changes in the position and depth of the point of Chappaquiddick, opposite the town. They also affect the manœuvring of vessels, which now do not like to anchor above Chappaquiddick Point. The fishermen state that the scour of those currents is injuring the clam and quahaug grounds, which are of much local value.

I have endeavored to ascertain whether the tidal currents through the harbor are stronger now than when the inlet of 1856 was open. From such facts as I could gather, however, they seem to be of about the same force. In 1856, a whale ship lying at the inner wharf was torn from her moorings, and carried eastward with the tide until her anchors were let go.

That these strong currents must produce changes in the physical condition of the harbor, seems self-evident. The very peculiar tidal phenomena connected with it, make the study of the subject one of special interest. Comparing the time the present inlet has been open, — about eight months, — with the eighteen or twenty years of less effective action since the former inlet closed, the probabilities are that the harbor channels and shoals are still in a transition state. During the next spring or summer, it may be

desirable to ascertain, by hydrographic survey, the degree of change which has taken place, and in what way the change of regimen affects the quality of the harbor. . . .

I append items from the local paper, the "Vineyard Gazette," relating to the opening of the new inlet.

Very respectfully submitted,

HENRY L. WHITING,

Assistant C. & G. Survey.

[From the "Vineyard Gazette," Edgartown, January 15, 1886.]

One of the results of Saturday's gale was the breaking through of the South Beach near the entrance to Katama Bay, — the first effectual opening from the harbor directly to the ocean in twenty years. The opening is reported to be 100 feet wide, and five or six feet in depth; and, it is believed, will be likely to stand for a number of years, — although there are those who dissent from this opinion. Assuming the permanency of the opening, however, its importance can hardly be overestimated. The long voyage around Cape Poge, with its attendant risks and exposure, and the long day required for a few hours' fishing, can be discontinued; and, instead thereof, will be substituted the safe and easy run down the harbor, with two chances a day for those who desire it. Summer visitors will enjoy the easy access to the fishing grounds now afforded, and the sojourners at Katama especially, — who have had heretofore to sail nearly around the island of Chappaquiddick to catch a bluefish, but who can now accomplish their purpose after a half-hour's run, — will find the change a most agreeable one. With proper legislation on the seining question, the new opening ought in all respects, — with the possible exception of the quahaug fishery, — to operate to the decided advantage of the town.

A Channel through the South Beach.

MR. EDITOR:— The report last Sunday morning that the South Beach had opened to the sea, fell at first on unbelieving ears. It was hardly credited, for some time, that the action of the waves and storm had so suddenly brought about a result so desirable, which the government had vainly expended, by the hands of engineers, \$20,000 to accomplish. It took from twenty-four to thirty-six hours to persuade the anxious fishermen of the favorable fact; and then, not till some of their number had actually visited the locality, and witnessed the waves of ocean rolling in through the breach into the harbor on the breast of the incoming tide.

The reopening of this passage is a cause for rejoicing with all classes and conditions of people. All regular fishermen, all those

who seek the fishing grounds simply for sport, the owners of Katama and of all lands along the harbor banks from the wharves to the beach, — all of these directly, and the whole community eventually, will feel the stimulating and revivifying effects of this important change. The grounds for this rejoicing are too apparent to need detailing here ; but the one fact that, for the next quarter of a century, the dwellers along the harbor shores will have for a daily summer spectacle the passing and repassing of a fleet of a hundred boats, over a beautiful sheet of water three miles long and from one to two miles wide, — to whose crews they can join themselves at pleasure, — must have a tendency to “boom” the lands in question for building purposes, more than anything that has yet occurred.

COM.

EDGARTOWN, January 14, 1886.

[C.]

[See page 32 of this Report, *ante*.]

COTAMY BEACH INLET AND SKIFF'S ISLAND.

BY PROF. HENRY L. WHITING.

U. S. COAST AND GEODETIC SURVEY OFFICE,
WASHINGTON, December, 1886.HON. JOHN E. SANFORD, *Chairman Harbor and Land Commissioners, Boston, Mass.*

DEAR SIR:—My report to the Superintendent of the Coast and Geodetic Survey, on my recent determination of changes in the shores of Martha's Vineyard, a copy of which has been sent to you from this office by his direction, contains some technical and official detail not quite germane, perhaps, to the interests in charge of your Board. On the other hand, there may be interests resulting from the *new Inlet* into Edgartown Harbor, and the increase of the former shoal, called "*Skiff's Island*," into veritable *upland*, of value to the State and to the local community, apart from those connected with the physical results of the survey. At least, they seemed to me so far inappropriate to the subject of my report, that I did not make them a part of it.

It seems quite natural, in such unexpected occurrences, that the public, as well as individuals, should come to hasty judgment and wrong conclusions in regard to them. Undoubtedly, many parties affected by the change are disappointed in the consequences following the opening of the new south Inlet into Edgartown Harbor. They find the change of tidal regimen, and the strong currents, more than they bargained for, when they were anxious to have an inlet opened artificially, at the time General Warren attempted to perform that operation fifteen years ago.

There are varied opinions, *pro* and *con.*, as to the nature of the effect of the new Inlet, both upon the harbor and the maritime interests of the town. The fishermen having larger boats, safe to go "outside," and drawing too much water to go through the new inlet, pronounce it "no good." The clam and scallop fishermen say the strong currents are injuring the beds where those bivalves have established themselves during the last fifteen years of comparatively slack water. Considering only these local and, in

many cases, personal interests, the more important question of the effect upon the main entrance into the harbor is forgotten or wilfully ignored.

The subject of the tidal phenomena peculiar to this particular locality, and their effect in maintaining the remarkable depth of channel into this valuable harbor of refuge, were fully discussed by Professor Mitchell, and made the basis of the memorials to Congress by the United States Advisory Council and the Harbor Commissioners, in 1870 or 1871, when recommending the appropriation, afterwards made, for opening the beach by artificial means. The present increased tidal currents are already deepening parts of the harbor which have silted up since the former inlet closed, precisely as predicted, by the loss of tidal scour.

The restored stronger current, at the maximum velocity of the tide, may, for the time being, make the manœuvring and anchoring of vessels somewhat troublesome; but this difficulty is not to be compared to the far greater disadvantage of a lessened depth of entrance into the harbor, which would undoubtedly occur, in time, with an insufficient scouring power. The clam and scallop beds may be injuriously affected, temporarily, but the general harbor ground, or more particularly that of Cotamy (or, as it is now more popularly called and spelled, Katama) Bay, seems natural to these shell-fish, and it is more than probable that new beds will be formed in other parts of the harbor and bay, more out of the range of the stronger currents, and where they can re-establish themselves.

In view of the history of the former openings through the south beach, it is safe to predict a movement of the present opening, which will undoubtedly take place to the *eastward*; and, when it reaches the firmer upland of Chappaquiddick Island, another long beach will probably form outside of it, until some heavy storm and sea throw it upon the main shore and close the opening, as former ones have been closed under similar circumstances and conditions.

To prevent this undesirable occurrence, it would seem of moment, while nature has made and is maintaining so fine an inlet, to consider the question of preserving it by arresting, if possible and practicable, this easterly movement, or at least retarding it; and I would respectfully suggest the advisableness of the action of your Board in this direction, and in calling the attention of Lieutenant Colonel Elliot, the United States Engineer in charge of this coast section, to the matter.

Another feature of interest and possible value to the State and locality, and also coming under the supervision of your Board, is the

increase, in size and stability, of the sand material of "Skiff's Island," alluded to and described in my official report. Will not this land, if reclaimed from the sea, become the property of the Commonwealth? If it can be protected and maintained against the action of heavier storms and sea-dash, it will afford a most valuable means of shelter in this exposed and, at times, dangerous fishing ground. A comparatively inexpensive work might be done, as an experiment, by covering the island, or parts of it, with brush secured in some practicable way. This would catch and hold the blowing sands and those otherwise swept away by waves, and might, by proper management, build up sand dunes sufficiently high to resist even the heavier wave action. If the island could be made secure enough to build fishing houses or huts upon, as at No Man's Land, where the fishermen could stay at night, and not be obliged to leave the fishing ground for the long trips back and forth to the harbor, — perhaps at the very time most favorable for fishing, — it would be a valuable auxiliary to the business and income of the town.

The waste at Cape Poge, and the encroachment of the sea line toward the foundations of the Light-house, are matters deserving of early attention; but these seem to belong more to the Light-house Department of the general government, than to your Board.

The foregoing items of fact and information came to my notice while engaged in my recent surveys, and I take pleasure in communicating them to you, in addition to the details of my official report before referred to.

I send with this a tracing of the several surveys which have been made, showing the respective changes in Cotamy Beach, and including my recent determination of Skiff's Island.

Very truly yours,

HENRY L. WHITING.

[D.]

[See page 33 of this Report, *ante*.]TIDAL CIRCULATION THROUGH EDGARTOWN HARBOR OCCASIONED BY
THE COTAMY INLET.

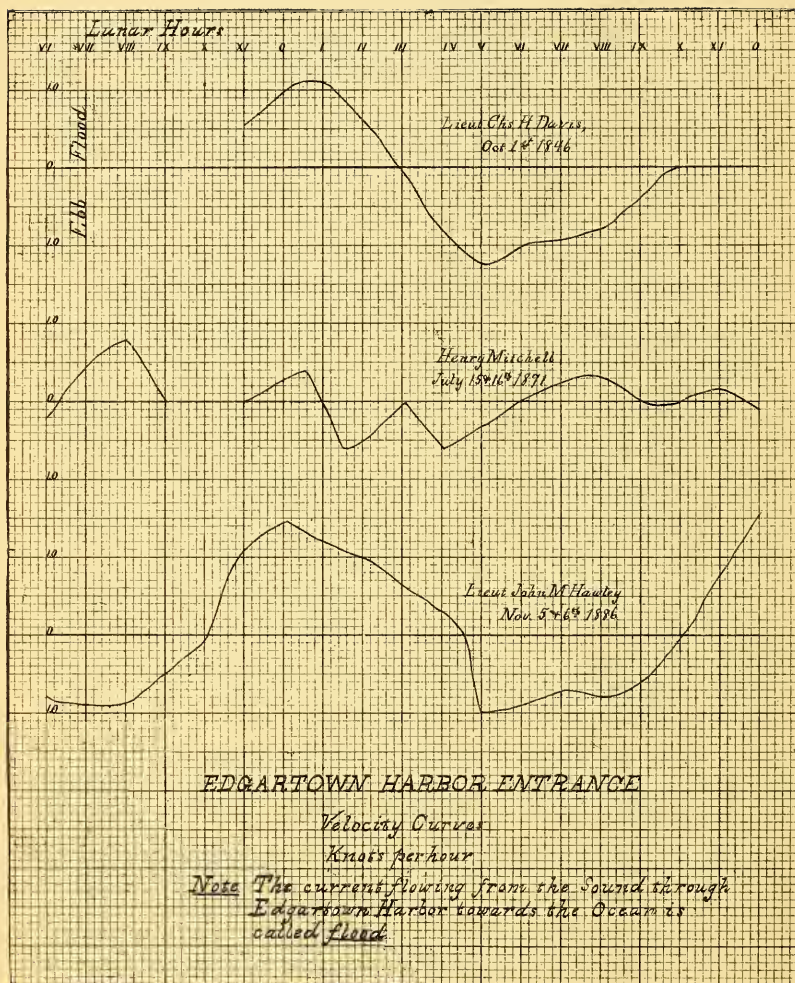
BY PROF. HENRY MITCHELL.

Not to enter again into a discussion of the peculiar tides of south-eastern Massachusetts, — which I have described at length in my article on “Physical Hydrography of the Gulf of Maine,” Appendix No. 10, Annual Report of Coast Survey for 1879,— I must remark that this little Inlet, which has broken through the Cotamy Beach, connects two diverse tidal systems. The tide on the southern coast of Martha’s Vineyard, belongs to the great Atlantic system; while that of the main entrance to Edgartown Harbor, belongs to the Gulf of Maine (or Bay of Fundy) system. The *node* in the ocean, lies off the south-eastern angle of Nantucket Island; while the *node* in the Sound, is found off West Chop.

When no southern Inlet exists, the tide which enters Edgartown Harbor is that of Nantucket Sound. It is distorted in profile because so near the *node*; but it distinctly belongs to the Gulf of Maine system, making its highest water about at the *Southing of the moon*.

At such times,— when the Inlet is closed,— Cotamy Beach separates two bodies of water that lie at one or two feet different elevations; and the current at the entrance to Edgartown Harbor is simply the filling and draining of the harbor, as the surface of the Sound rises or falls; but when the Cotamy Inlet is open, the current is due to the slope between the Sound and the ocean.

And there is this important difference between the two cases, viz.: — *With Cotamy Inlet closed, the velocity of the current would be lessened by deepening the entrance from the Sound; but with the Inlet open, the enlargement of the passage-way through from Sound to ocean would quicken the currents.* There is no doubt, in my mind, that the harbor entrance could be successfully dredged with the inlet open, but not permanently with the inlet closed.



I append a diagram showing how the current ran by the town in 1846, when the inlet through Cotamy was open; how it ran in 1871, when the inlet was closed; and how it ran in 1886, when the inlet reopened. The first set of observations was made by Lieut. Commander Charles H. Davis; the second set by my party; and the last set by Lieut. John M. Hawley.

The first and last sets agree in general, while the intermediate set presents a totally different aspect. The stations were all in the entrance, but not identical. The observations were not made at the same phase of the moon, but they all fell between seven and one-half and eleven hour transits; that is, in either small or average run of tides. Lieutenant Hawley's observations fell at just about the average, and gave no higher velocities than one and a half knots per hour; while Lieutenant Davis worked at neap tides, and found nothing higher than one and a quarter knots per hour.

The key to all the epochs of this neighborhood, is furnished in the following rule: --

In the Sound, abreast of Edgartown, it is *high water* and it is *slack water* at the *Southing of the moon*. At this juncture, the southerly current through Edgartown Harbor reaches its *strength*.

The "slack water" referred to above, is the turn of the current from an easterly to a westerly direction.

HENRY MITCHELL.

WASHINGTON, December 8, 1886.

[E.]

[See page 9 of this Report, *ante*.]

AN AGREEMENT, MADE THIS THIRTIETH DAY OF DECEMBER, 1886,
BY AND BETWEEN THE NEW ENGLAND DREDGING COMPANY, PARTY
OF THE FIRST PART, AND THE COMMONWEALTH OF MASSACHUSETTS,
PARTY OF THE SECOND PART.

WHEREAS, the said parties have heretofore, to wit, on the first day of July, 1882, entered into certain Articles of Agreement in relation to material dredged by other parties, and the receiving and depositing of the same by said party of the first part on a certain area of flats in South Boston, which articles of agreement are to be referred to as a part hereof;

And, Whereas, by subsequent agreements of June 20, 1884, and August 1, 1885, which are also to be referred to as a part hereof, said Articles of Agreement were extended and continued in force for the term of two years, four months and fourteen days, in all, beyond the original term thereof, and were also modified in respect to the area of flats to be filled, and in certain other particulars specified in said subsequent agreements;

And, Whereas, said Articles of Agreement, as so extended and modified, expire on the first day of January, 1887;

It is hereby further agreed by the parties hereto, that the said Articles of Agreement, as so extended and modified, shall be, and hereby are, extended and continued in force for a still further term of one year, so as to expire on the first day of January, 1888; but such extension shall not operate to postpone the payment to said party of the first part of the percentage of the contract price, reserved by said party of the second part, upon work finally completed on or before said first day of January, 1887, and accepted by said last-named party.

It is also further agreed by the parties hereto, that there shall be substituted for the area of flats to be filled as specified and described in said subsequent agreement of August 1, 1885, a certain other area, which includes a portion of the former, and is bounded as follows, to wit: Northerly by a line drawn parallel to

and one thousand feet distant northerly from the southerly line of Cypher Street, so called; Southerly by a line drawn parallel to and three hundred feet distant northerly from said southerly line of Cypher Street; Easterly by a line drawn parallel to and one hundred feet distant easterly from the easterly line of D Street extended; and Westerly by the westerly line of C Street extended.

Nothing herein contained shall be so construed as to change or impair any of the provisions of the aforesaid Articles of Agreement, as modified by the aforesaid subsequent agreements, except so far as they are further modified by the express provisions of this agreement.

IN WITNESS WHEREOF, the said NEW ENGLAND DREDGING COMPANY, by Charles H. Souther, its President and Treasurer, thereunto duly authorized, has caused its corporate seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf; and the said COMMONWEALTH, acting by its Board of Harbor and Land Commissioners, has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf, the day and year first above written, and the same to be approved by its Governor and Council.

NEW ENGLAND DREDGING COMPANY,

By CHARLES H. SOUTHER, [SEAL OF THE NEW ENGLAND
DREDGING CO.]
President and Treasurer.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
CHARLES H. HOWLAND, } *Commissioners.*

In Council, January 12, 1887. Approved.

Witness the Seal of the Commonwealth,

[SEAL OF THE
COMMONWEALTH.]

HENRY B. PEIRCE, *Secretary.*

[F.]

[See page 10 of this Report, *ante*.]

AN AGREEMENT, MADE THIS EIGHTEENTH DAY OF AUGUST, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, AND SUBJECT TO THE APPROVAL OF ITS GOVERNOR AND COUNCIL, PARTY OF THE FIRST PART, AND MICHAEL J. COLLINS, OF BOSTON, IN THE COUNTY OF SUFFOLK AND COMMONWEALTH AFORESAID, PARTY OF THE SECOND PART.

Said party of the second part agrees with said party of the first part, to do all the work, and furnish all the materials, for building a 36 x 50 inch main brick sewer, about 1,375 feet long, in C Street, on the South Boston Flats, and pipe sewers connecting therewith in the intersecting streets, with man-holes, catch-basins and connections, and for connecting the main sewer with the city sewer in First Street, all as shown on Plans on file in the office of the Board of Harbor and Land Commissioners, marked "*South Boston Flats Sewers, A, B, C, D, E and F, July, 1886,*" which Plans are to be referred to as a part of this agreement; it being understood, however, that no sewer or other work or details shown on said Plans north of the intersecting street next north of Mount Washington Avenue extended, are to be considered as in any manner referred to or included herein.

All excavations to be made true to line and grade as given to said party of the second part, the invert of bottom of sewer trenches to be formed exactly to the shape of the outside of the sewer. If any excavation is made too deep, it is to be refilled to proper grade with suitable material well rammed into place.

The trenches to be thoroughly braced and planked in and near First Street, and wherever necessary, and to be kept free from water during the progress of the work, and only such length opened at once as directed by the Inspector.

All the work in and near First Street to be done in a manner satisfactory to the city authorities, and to be kept lighted and fenced as provided in the ordinances of the city, and said party of

the second part to be responsible for all damages arising from, or in consequence of, the construction of the sewer and other work. All injuries to water and gas or other pipes to be made good by said party of the second part.

First Street to be left in as good condition as before opening, and along the line of the sewer to be kept in good repair by said party of the second part for six months after the completion of the work in said street, if required by the city authorities.

The main sewer in C Street to be of brick, egg-shaped, 36" x 50" from the city sewer in First Street to man-hole No. 5, as shown on Plans, the brickwork to be eight inches thick throughout.

Man-hole No. 5 to be so built that a main sewer may be hereafter extended northerly therefrom of a size 30" x 42", egg-shaped, and the outer end of the main sewer at said man-hole to be securely bricked up.

The backing of the haunches to be packed solid and rammed, and the brickwork covered before drawing centres. Centres to remain as long as forty-eight hours after the brickwork is completed, if required by the Inspector.

All slants for connections to be built into the brickwork as it proceeds, and the outer ends left carefully stopped.

Man-holes to be built of brick and in the manner shown on the Plans, and to be capped with a cast-iron curb and cover like the regular city curb and cover. The brickwork to be eight inches thick throughout.

The sewers in the streets intersecting C Street to be of 12-inch Akron or Portland salt-glazed sewer pipe, laid to line and grade as given to said party of the second part, with joints close butted and well filled with mortar, and scraped clean inside after laying, and not bearing on the sleeves. Branches to be put in as directed by the Inspector, and left carefully stopped.

The catch-basins to be built according to the Plans, of spruce timber, sawed square, sound and free from large knots, and connected with the sewer by 10-inch Akron or Portland salt-glazed sewer pipe, laid as provided for the pipe sewer.

All bricks used to be hand-made, uniform in size, regular in shape, tough and burned very hard entirely through. No bats to be used, except a small proportion in the outer ring of the arch and outer course of man-holes. The most regular bricks to be selected for the inner ring of the invert of sewer.

All bricks to be laid in mortar composed of two parts of clean, sharp sand, and one part of best American cement, fresh mixed; joints to be full and laid to line; joints of invert to be struck with

trowel ; bricks to be well wetted before laying, and to be laid by experienced masons.

Cement to be fine ground ; clear cement mortar to be capable of sustaining a tension of forty pounds per square inch twenty-four hours after mixing.

The best dirt from the trenches, entirely free from stones, to be carefully rammed around the sewer and pipes, and the remainder placed in the trenches in layers of not over two feet, and thoroughly rammed or puddled. Any surplus material from excavations to be deposited and levelled in places and in a manner directed by the Inspector, but no such surplus material to be required to be moved more than one hundred feet from place where excavated.

No allowance to be made for any loose stones or bowlders found in excavating.

The work to be kept perfectly clean and free from brickbats, dirt, etc., as built, and the whole to be done subject to the inspection and direction of the Engineer of said Board and his Inspector at all times.

The number and location of the pipe sewers, man-holes, catch-basins and connections, slants and branches, as shown on Plans, may be varied by direction of said Engineer or his Inspector, notice of changes being given to said party of the second part in season so as not to require any alteration of work already done, and the additions or omissions not to exceed fifty per centum of those shown on the Plans.

Any details shown on the Plans, and not mentioned herein, must be considered a part of this agreement, and are to be fulfilled by said party of the second part.

In all questions which may arise concerning measurements, lines and grades, the decision of said Engineer shall be final.

All necessary aid and materials for giving or indicating lines and grades must be furnished by said party of the second part at his own expense ; and convenient facilities must be furnished whenever requested for the inspection of the work.

All instructions and directions of said Engineer, or his authorized assistants, must be strictly observed and followed.

All of the work must be done to the satisfaction of said Engineer, and in a manner to be approved by him, and to the acceptance of said Board.

The work must be commenced immediately, and must be prosecuted vigorously in all suitable weather until completion ; and must be fully completed on or before the thirtieth day of November, 1886.

Estimates will be made by said Engineer of the amount of work done and completed up to the end of each calendar month, and

payment will be made thereon of seventy-five per centum of the contract prices for such work, as computed by said Engineer ; and the remaining twenty-five per centum will be paid upon the final completion and acceptance of the whole work.

And said party of the second part hereby agrees to do all the work, to furnish all the materials, and to do, furnish, perform and complete all other things provided for in the foregoing specifications and plans, subject to the terms and conditions therein set forth, for the following prices or sums, the same to be in full compensation for all the work, materials, and other things done, furnished, performed and completed as aforesaid, namely : —

For the 36 x 50 inch sewer, per running foot, five dollars and twenty-five cents (\$5.25) ; for each 12 inch slant built in, two dollars (\$2.00) ; for each 10 inch slant built in, one dollar and fifty cents (\$1.50) ; for each 6 inch slant built in, fifty cents (\$0.50) ; for 12 inch pipe sewer, per running foot, seventy-five cents (\$0.75) ; for each branch of same, twenty-five cents (\$0.25) ; for each catch-basin, twenty-seven dollars (\$27.00) ; for catch-basin connections, per running foot, fifty cents (\$0.50) ; for each man-hole, including curb and cover, thirty-five dollars (\$35.00).

And said party of the first part, for the considerations aforesaid, hereby agrees to pay to said party of the second part the prices or sums aforesaid, at the times and in the manner, and upon the terms and conditions, hereinbefore set forth.

IN WITNESS WHEREOF, said party of the first part, acting by its Board of Harbor and Land Commissioners, has caused these presents to be executed in its name and behalf, and to be approved by its Governor and Council, and its seal to be hereto affixed ; and said party of the second part has hereto set his hand and seal, the year and day first above written.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD,)	<i>Harbor and</i>
JOHN I. BAKER,)	<i>Land</i>
JOSEPH K. BAKER,)	<i>Commissioners.</i>

MICHAEL J. COLLINS.

[SEAL.]

In Council, August 27, 1886. Approved.

Witness the Seal of the Commonwealth,

[SEAL OF THE
COMMONWEALTH.]

HENRY J. COOLIDGE, *Deputy Secretary.*

MEMORANDUM OF AGREEMENT, MADE SEPTEMBER 1, 1886, FOR
BUILDING FOUNDATIONS FOR C STREET SEWER.

WHEREAS, it may be found necessary to construct artificial foundations for a portion of the sewer agreed to be built by me in C Street, on the South Boston Flats, as per agreement with the Commonwealth of Massachusetts, dated August 18, 1886, I hereby agree to construct such foundations upon the following terms and conditions: —

Said foundations are to be built as shown by Figure No. 1, or by Figure No. 2, on a Plan on file in the office of the Board of Harbor and Land Commissioners, marked "South Boston Flats Sewers, G, August, 1886." The location and length of each kind of foundation to be subject to the determination of the Engineer of said Board as the work proceeds. All details shown on said plan to be followed, though not herein specified.

The foundation shown by Figure No. 1, to consist of two parallel lines of long spruce stringers, 6 x 12 inches, laid in the trench to grade given by said Engineer, and to be covered with a floor, 5 feet wide, of 3 inch spruce plank well spiked to the stringers.

The trench to be filled up to the level of the top of the stringers with clean clay or gravel well rammed into place before the floor is put on.

To carry off the water during construction, a 6 inch drain pipe is to be laid to grade given by said Engineer, under the floor between the stringers, and every precaution taken to prevent the clogging of said pipe.

On the top of the floor, brick walls are to be built as shown on the plan, with their inner faces conforming to the outside of the invert of the sewer.

The foundation shown by Figure No. 2, to be of the same construction as that shown by Figure No. 1, except that the stringers are to be 10 x 12 inches, and are to rest on spruce piles, to which they are to be secured by 1 inch spike bolts 18 inches long. The stringers to be in as long lengths as possible, and the joints to come on the piles.

The piles to be straight and free from large knots, to be not less than 10 inches in diameter at the butt when cut off, and not less than 6 inches in diameter at the point. They are to be driven in two rows, one on each side of the centre line of the sewer, and 1 foot and 9 inches from said centre line, and the piles are to be not over 5 feet apart on centres in the rows.

The piles are to be driven not less than 10 feet into the hard bottom, and are to be cut off and trimmed to receive the caps at grades given by said Engineer. All piles injured in driving to be replaced by sound ones.

All of the provisions of said sewer agreement of August 18, 1886, in respect to the kind and quality of materials and workmanship, the supervision, inspection, measurement and acceptance of the work, the terms of payment, and otherwise, are, so far as may be applicable, to apply to the work herein contracted for.

I hereby agree to do all the work, to furnish all the materials, and to do, furnish, perform and complete all other things provided for in the foregoing Specifications and Plan, subject to the terms and conditions therein set forth, for the following prices or sums, the same to be in full compensation for all the work, materials, and other things done, furnished, performed and completed as aforesaid, namely: —

For each running foot of foundation shown by Figure No. 1, three dollars and sixty cents (\$3.60) ;

For each running foot of foundation shown by Figure No. 2, six dollars and thirty cents (\$6.30) ; and no extra or additional compensation is to be claimed under said sewer agreement, by reason of this agreement or otherwise, except as herein expressly provided.

MICHAEL J. COLLINS. [SEAL.]

[G.]

[See page 12 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS FIRST DAY OF APRIL, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-SIX, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, PARTY OF THE FIRST PART, AND THE EASTERN DREDGING COMPANY, A CORPORATION ESTABLISHED UNDER THE LAWS OF THE STATE OF MAINE, AT PORTLAND IN SAID STATE, PARTY OF THE SECOND PART.

The said Party of the Second Part hereby covenants and agrees with the said Party of the First Part, to do and complete all the work specified and described in the following Specifications for the removal by dredging of a portion of Junction Shoal at the mouth of Charles River in Boston Harbor, — all of said work to be done and completed in the manner, and in accordance with and subject to the terms and conditions, in said Specifications set forth : —

SPECIFICATIONS.

The area to be dredged extends from near the Chelsea Ferry Landing to near Atkins Wharf, and contains about 344,600 square feet. The location and dimensions of this area are more exactly shown on a Plan on file in the office of the Board of Harbor and Land Commissioners, entitled “Plan of Junction Shoal, Charles River, surveyed December, 1885. Scale $\frac{1}{10000}$.” This plan is to be referred to as a part of these Specifications.

The amount of material on the above area between the present bottom and the plane of 23 feet below mean low water, is about 32,500 cubic yards.

The least present depth of water on the above area is about 16.8 feet at mean low water, and the average cut is a little over 2.5 feet.

All of the above area is to be dredged so that it shall have, when the work is completed, a depth of not less than 23 feet below the plane of mean low water.

The banks at the edges of the above area must be sloped off sufficiently to maintain the required depth over the whole of said area, and no extra payment or allowance will be made for such sloping, nor for any excavation below the required depth.

All ledges and bowlders which may be found, and which can be removed by dredging, are to be removed as a part of the contract without extra payment or allowance; but if any ledges or bowlders are found which cannot be removed by dredging, the covering material must be dredged away and the ledges and bowlders left bare to the depth aforesaid; and the Engineer of said Board shall be the sole judge to determine whether any ledge or bowlder can be removed by dredging or not.

All of the material dredged is to be deposited alongside the pier or elevating station maintained and operated by the New England Dredging Company on the South Boston Flats, near Monks Wharf, or at such other place on said Flats as may from time to time be directed by said Engineer; and all dumping of such material must be done within one hour and one-half before or after high water.

The aforesaid Plan, and the surveys and calculations based thereon, are believed to be correct; but the said party of the second part must examine for itself before signing this agreement, as no allowance will be made for any errors or inaccuracies which may be found therein.

In all questions which may arise concerning measurements, lines, and grades, the decision of said Engineer shall be final.

All necessary aid and materials for giving or indicating lines and grades must be furnished by the said party of the second part at its own expense; and convenient facilities must be furnished whenever requested for the inspection of the work.

All instructions and directions of said Engineer, or his authorized assistants, must be strictly observed and followed.

All of the work must be done to the satisfaction of said Engineer, and in a manner to be approved by him, and to the acceptance of said Board.

The work must be commenced on or before the first day of May, 1886, and must be prosecuted vigorously in all suitable weather until completion; and must be fully completed on or before the thirtieth day of September, 1886.

Estimates will be made by said Engineer of the amount of work done up to the end of each calendar month, and payment will be made thereon of 75 per centum of the proportional part of the whole contract price applicable to such work, as computed by said Engineer; and the remaining 25 per centum will be paid upon the final completion and acceptance of the whole work.

And the said party of the first part, in consideration of the performance and completion of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the said party of the second part the sum of ten thousand and four hundred dollars (\$10,400), said sum to be in full therefor, and to be paid at the times, and in the manner, and upon the terms and conditions, set forth in the foregoing Specifications.

IN WITNESS WHEREOF, on the day and year first above written, the said COMMONWEALTH OF MASSACHUSETTS, acting by its said Board of Harbor and Land Commissioners, hath caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereunto affixed, and hath also caused these presents to be approved by its Governor and Council; and the said EASTERN DREDGING COMPANY, by George E. Runyan, its Treasurer, thereunto duly authorized, hath caused these presents to be signed and delivered in its name and behalf, and its corporate seal to be hereunto affixed.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD, } *Harbor and*
JOHN I. BAKER, } *Land*
JOSEPH K. BAKER, } *Commissioners.*

EASTERN DREDGING COMPANY,

By GEORGE E. RUNYAN, [SEAL OF THE EASTERN
DREDGING CO.]
Treasurer.

In Council, April 14, 1886. Approved.

Witness the seal of the Commonwealth,

[SEAL OF THE
COMMONWEALTH.]

HENRY B. PEIRCE, *Secretary.*

[II.]

[See page 14 of this Report, *ante*.]

ROWLEY RIVER RAILROAD BRIDGE.

ADJUDICATION OF THE RAILROAD COMMISSIONERS AND HARBOR AND
LAND COMMISSIONERS UNDER CHAPTER 261 OF THE ACTS OF 1886.

COMMONWEALTH OF MASSACHUSETTS.

The Railroad Commissioners and the Harbor and Land Commissioners, sitting as a Joint Commission under the provisions of Chapter two hundred and sixty-one (261) of the Acts of the year eighteen hundred and eighty-six (1886), entitled "An Act relating to the bridge of the Eastern Railroad Company across the Rowley River," having given due notice to all persons interested in or affected by the maintenance of a draw in the railroad bridge of the said Eastern Railroad Company over the said Rowley River in the town of Rowley, by two publications each in the "Newburyport Daily Herald" and the "Ipswich Chronicle," a copy of which notice is hereto appended, and also by sending a like notice, in writing, to the Selectmen of each of the towns of Rowley and Ipswich, proceeded, as instructed by said Act, and pursuant to said notice, to give a hearing at the Eastern Railroad station in said Rowley, on the twenty-seventh day of October, 1886, to all persons interested or affected as aforesaid and desiring to be heard; and, having heard the same, and having fully considered all the facts appearing in the case and what the public interests may demand in the premises, the said Commissioners, as empowered by the Act aforesaid, do hereby authorize the said Eastern Railroad Company to reconstruct and alter its railroad bridge aforesaid, in the manner, and subject to the condition and reservation following, namely:—

The present pile bridge, with the draw, draw-piers, and all other parts and appurtenances of said bridge and draw in and over said river, is to be wholly removed. A new bridge, of sufficient width for two railroad tracks, is to be built over said river, in the same

location, without a draw therein, in substantial conformity in all respects with the plans hereto appended, which plans are referred to and made a part hereof. Said new bridge is to have substantial stone abutments, with one substantial stone pier between the same, affording, after said bridge is completed, two openings for the passage of boats and other craft under said bridge, each of which openings shall have a clear width of not less than forty-five (45) feet, as shown on said plans. The span or opening on the southerly or Ipswich side of the river, shall have a clear height of not less than seventeen and six-tenths ($17\frac{6}{10}$) feet above the plane of mean low water, and of not less than ten and three-tenths ($10\frac{3}{10}$) feet above the plane of mean high water; and the sides of said span or opening shall be covered with planking, as shown on said plans, for the convenience and safety of boats and other craft passing through the same. The span or opening on the northerly or Rowley side of the river, shall have a clear height of about fifteen (15) feet above the plane of mean low water, and of about seven and seven-tenths ($7\frac{7}{10}$) feet above the plane of mean high water, as shown on said plans. The location of the abutments and central pier, and all the details of construction of the same, and of the superstructure of said bridge, shall be substantially as shown on said plans. Duplicates of said plans are on file in the office of said Harbor and Land Commissioners.

The authority to build and maintain a bridge without a draw, as aforesaid, is given to the said Eastern Railroad Company subject, however, to the express condition and reservation, that the General Court may, at any time hereafter, require said railroad company, its successors or assigns, to construct and maintain a draw in said bridge; and it or they shall, at all times and in all respects, conform to the directions and requirements of the General Court in relation thereto.

IN WITNESS WHEREOF, the said Railroad Commissioners and Harbor and Land Commissioners have hereunto set their hands, at Boston, this first day of November, in the year eighteen hundred and eighty-six (1886).

THOMAS RUSSELL,	}	<i>Railroad Commissioners.</i>
EDWARD W. KINSLEY,		
EVERETT A. STEVENS,		
JOHN E. SANFORD,	}	<i>Harbor and Land Commissioners.</i>
JOHN I. BAKER,		
JOSEPH K. BAKER,		

[COPY OF NOTICE.]

COMMONWEALTH OF MASSACHUSETTS.

The Railroad Commissioners and the Harbor and Land Commissioners, sitting as a Joint Commission under the provisions of Chapter 261, Acts of 1886, will give a hearing to all persons interested in or affected by the maintenance of a draw in the railroad bridge of the Eastern Railroad Company over Rowley River, in the town of Rowley, in relation to repairs, reconstruction or alteration of said bridge by said Eastern Railroad Company, at the Eastern Railroad station in said Rowley, on Wednesday, October 27, 1886, at half-past eleven o'clock in the forenoon.

THOMAS RUSSELL,

Chairman Railroad Commissioners.

JOHN E. SANFORD,

Chairman Harbor and Land Commissioners.

OCTOBER 15, 1886.

[I.]

[See page 8 of this Report, *ante*.]

REMOVAL OF THE HOTEL KENSINGTON BAY-WINDOWS.

The last Report of this Board, pages 21 to 47, contained a detailed statement of the facts respecting the erection by Mr. Henry Bigelow Williams of a building, known as the *Hotel Kensington*, on the Back Bay district, with *bay-windows* projecting therefrom into and over the *passage-way* in the rear of the premises, in violation of the stipulations in the deed of purchase from the Commonwealth.

A sketch was also given of the proceedings in the Supreme Judicial Court, upon an Information in equity filed by the Attorney General at the relation of this Board, for the *removal* of the windows in question, — in which, after a protracted litigation, and after the cause had been twice argued before the Court sitting in full bench, a final decree had been entered for their removal within thirty days. The case has since been officially reported, — *Attorney General v. Henry B. Williams*, 140 Mass. Reports, page 329.

In view of the lateness of the season for out-door work when the final decree was obtained, — November 24, 1885, — consent had been given for delaying the execution of the decree until the following spring, and an obligation taken for the removal of the windows when that time should arrive; and matters were left in this posture by the last Report.

In order to complete the history of the case, it is necessary to add the following facts: As the time agreed upon for the removal of the windows approached, and steps, as the Board was informed, were already taking in that direction, a Bill in equity was filed, March 22, 1886, in the Circuit Court of the United States, Massachusetts District, in the name of one William W. Bailey, a citizen of New Hampshire, against Henry Bigelow Williams and the members of this Board; and the respondents were severally summoned to appear and show cause why a *writ of injunction* should not issue restraining the said Williams from removing the bay-windows.

The Bill alleged, in substance, that the plaintiff Bailey was the holder of a note of \$150,000 secured by a mortgage on the Hotel Kensington premises, and that the conveyance from the Commonwealth to Williams, and the mortgage deed of even date from Williams to Bailey, had been made under such circumstances and with such covenants, that the Commonwealth was estopped to compel the removal of the windows as against Bailey; and relief in equity was prayed for on the ground that such removal would so diminish the value of the premises as to impair the security and imperil the collection of the mortgage debt.

The Attorney General and his Assistant, who had so ably conducted the former proceedings in the State Court, appeared for the Commonwealth at the several hearings in the Circuit Court. Pending these hearings, the plaintiff Bailey amended his bill by discontinuing as against the members of this Board; and, the defendant Williams not appearing in the case, it was claimed that there were now no parties entitled to defend, that the bill should be taken as confessed as against Williams, and that the plaintiff was entitled as of right to the decree of injunction prayed for.

It was held, however, by the Court, GRAY and COLT, JJ., that an injunction would not issue as of course for want of parties entitled to defend, but that the Court would of its own motion, before issuing an injunction, inquire into the merits of the case; and that, upon the facts appearing in this case, it must be presumed that the construction put by the State Court on the stipulations in the Commonwealth's deed to Williams was correct, and that Bailey was bound by its decree because he held his title as mortgagee expressly subject to the incumbrance created by those stipulations. The prayer for an injunction was accordingly refused, and the *Bill dismissed*.

After this decision, Mr. Williams proceeded with the execution of the decree of the State Court, and the bay-windows were wholly removed during the summer of 1886.

ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS

FOR THE YEAR 1887.

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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate and the House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submits its Annual Report for the year 1887.

SOUTH BOSTON FLATS.

The work of harbor and flats improvement at South Boston has been carried forward without material change of the plan and methods of operation described in previous reports.

Progress of the Work.

A tract of flats and tide-water land containing $99\frac{46}{100}$ acres, which may be called for convenience the 100-acre lot, has been in process of filling and improvement by the Commonwealth for several years past. It adjoins on the east the tract of $82\frac{6}{100}$ acres previously sold to the New York and New England Railroad Company, and now occupied by that company for its terminal freight grounds. It is crossed north and south by B, C and D streets, and east and west by Congress Street and a system of proposed parallel streets. A plan showing its location and projected lay-out was appended to the last report.

The work of the last year has been mainly expended in completing the filling of this 100-acre lot with dredged material to the grade of 13 feet above mean low water, and in the construction of sewers and streets with a view to

putting a considerable section of the lot in condition for immediate sale and occupation for business uses.

Filling.

There have been deposited on this lot, during the last year, about 65,000 cubic yards of material, equivalent, when levelled, to 5 acres filled to grade 13, and making, with the work of previous years, $97\frac{7}{10}$ acres in all completed to that grade. The bulk of the last year's filling was dredged material, deposited by the New England Dredging Company under its Contract No. 2, so called, the terms of which have been stated in previous reports. The amount of material required to complete the contract had all been furnished in April last. A few hundred yards remain to be levelled before the contract can be closed.

Only about $1\frac{3}{4}$ acres of the 100-acre lot remain to be filled to grade 13. This small area is the remnant of a larger section purposely reserved to be filled, and now in process of filling, with ashes and other suitable refuse material supplied at small cost in carts by the city of Boston and other parties having such material to waste.

In addition to the above filling on the 100-acre lot, there have been dumped from scows, on the adjoining flats towards E Street, about 90,000 cubic yards of material dredged from the harbor by contractors with the United States and other parties who desire or are required to use these flats as a dumping ground. This material is obtained without cost to the Commonwealth, and the filling so done is preliminary to the occupation and improvement of an additional tract of flats in enlargement of the 100-acre lot.

It is estimated that the amount of material deposited by the New York and New England Railroad Company on its adjoining 12-acre lot, below grade 13, is between 4,000 and 5,000 cubic yards of ashes and other refuse material.

Drainage.

A contract * was made early in the year for the extension, on the 100-acre lot, of the system of drainage begun the previous year, of which a description was given in the last

* See Appendix, A.

report. Under this contract, 1,293 feet of 30 x 42-inch main brick sewer were built the last year in C Street, and 2,240 feet of connecting pipe sewer were laid in the cross streets, with man-holes, catch-basins and connections, all of approved plan and construction, and conforming to the system of the city of Boston with which connection is made in First Street. Provision has thus been made for the drainage of all the filled territory lying between B and C streets and between First and Congress streets; and the system admits of further extension over a still larger area as occasion may require.

Street Grading.

In August last a contract * was made with the New York and New England Railroad Company for filling with gravel, to final grade 16, the streets upon that section of the 100-acre lot covered by the sewer construction above described. By the terms of the contract, C Street was to be graded 60 feet wide from the southerly line of Cypher Street to the northerly line of Congress Street, and B Street (already 50 feet wide) was to be widened to 60 feet for the same distance. The nine cross streets within these limits were to be graded, between B and C streets, 50 feet wide each, except Congress Street, which was to be 75 feet wide. The railroad company also agreed to complete to the same grade and width, at its own cost, the filling with gravel of the unfinished portion of Congress Street upon its own grounds, easterly to B Street. The work has been completed except the grading of Cypher Street, about one-half of C Street, and a short section of B Street. It will be resumed and finished early in the summer.

By comparing the above specifications with the plan appended to the last report, it will be seen that it has been thought best to widen B and C streets to 60 feet each, in conformity with D Street, and to reduce the width of Mt. Washington Avenue (as shown on the plan) to 50 feet, in conformity with the other cross streets.

The section of the 100-acre lot covered by the completed sewer and street construction above described, contains 8 rectangular blocks of land, bounded by streets from 50

* See Appendix, B.

to 75 feet wide, and having an aggregate area (exclusive of streets) of $971,555\frac{37}{100}$ square feet, or about $22\frac{1}{3}$ acres. This land is now held for sale. A lot of 28,562 square feet, at the corner of Congress and B streets, was sold the latter part of the last year—the first sale from the 100-acre lot.

Reserved Channel.

The question whether or not there shall be a “reserved channel” over the flats east of E Street, to connect the wharves and flats of the shore proprietors with the main ship channel, is one that must be settled before definite plans can be made for extending the improvement much further in that direction. The best and only practicable way in which it can be settled *in favor of* such channel, is by mutual concessions and co-operation between the shore proprietors and the Commonwealth; and considerable progress has been made in that direction. To aid in a definite solution of the matter, an instrument, in the nature both of a deed and an agreement,* was drawn up by the Board for submission to the proprietors, and they were invited to meet the Board, in December just past, to consider its provisions. Nearly all of the proprietors were present or represented at the meeting.

The terms of the instrument were intended to be not only just but liberal on the side of the Commonwealth, and have been so received by the proprietors, most of whom have either signed it or declared their purpose to do so; and it is believed that it will be found for the interest of all the proprietors to become parties to its provisions. If such is the result, and if the plan and terms proposed meet with the approval of the governor and council, the main points in respect to the location and features of the channel will have been adjusted.

It will be seen that the instrument referred to provides for the establishment of a channel beginning at E Street and extending eastward only as far as a point midway between O and P streets. This, of course, is not its terminus in that direction. At this point the channel, as now proposed, would bend with the shore a little towards the south, and then follow the northerly line of the projected

* See Appendix, C.

city marine park, as established by chapter 427 of the Acts of 1887, until it enters the main ship channel just above Castle Island. Such location would give a reserved channel of easy alignment throughout for the passage of vessels, would afford all of the shore proprietors ample and convenient access to the sea, and would not only be the most desirable with a view to the beauty and attractiveness of the city park, but would also utilize to the best advantage the territory of the Commonwealth north of the channel which it is proposed to reclaim.

As no questions were likely to arise in respect to the location of this part of the channel, it was not deemed necessary to cover it by the deed and agreement in question.

Provision for Continuing the Work.

The balance in the "Commonwealth's Flats Improvement Fund" on the first day of January, 1887, available for carrying on the work, was \$38,998.81; to which there have been added during the year, \$1,227.71 from income of the fund, \$1,836 received from the New York and New England Railroad Company for overflow filling, \$14,281 proceeds of land sold, and \$75,000 paid into the fund from the treasury of the Commonwealth under the provisions of chapter 28 of the Acts of 1887; making a total of \$131,343.52 available for the work. Of this sum there has been expended during the year \$64,528.07, leaving an available balance, January 1, 1888, of \$66,815.45. In order to provide for the work now in contemplation, it is estimated that it will not be necessary to make provision for the payment of more than \$10,000 into the fund the present year.

The last appropriation from the Commonwealth's Flats Improvement Fund for the prosecution of the work at South Boston was made by chapter 46 of the Resolves of 1886. As two years have now elapsed, it will be necessary to renew the appropriation at the present session of the legislature.

RECEIPTS FROM GRANTS OF TIDE-WATER LANDS.

The amount received during the past year for grants of rights and privileges in tide-water lands of the Commonwealth, under licenses of this Board for filling and for the erection of wharves and other structures in and over tide-waters, is \$39,576.75. Other like assessments for a considerable amount have been made during the year, for which the money has not yet been paid into the treasury. Payment for such grants was first required by chapter 284 of the Acts of 1874, now chapter 19, section 16, of the Public Statutes. Since the passage of that act, the total amount so received and paid into the State treasury has been \$197,992.41. All receipts from this source are, by chapter 8 of the Resolves of 1872, pledged and paid into the Troy and Greenfield Railroad sinking fund.

The effect of the act of 1874 has been highly salutary, not only by turning a considerable revenue into the treasury, but by discouraging greedy or speculative raids upon the public domain.

BOSTON HARBOR.

By the last river and harbor act, passed August 5, 1886, congress appropriated for Boston Harbor the sum of \$56,250, of which \$18,750 was specifically allotted for the improvement of Fort Point Channel below Congress Street bridge.

The commercial importance of Fort Point Channel seems to have largely increased within the last twenty years. In 1866, and for some years before, the expediency of filling up and closing this channel in whole or in part was seriously discussed by commissions and special committees of the legislature, in connection with the scheme for the improvement of the harbor by the occupation of the South Boston Flats. The project was rejected, however, by the highest authorities, both on grounds of commercial expediency, and as a means of harbor improvement.

Large sums had been expended by the Commonwealth in deepening and improving Fort Point Channel, and in removing the shoals at its mouth, and very considerable amounts by private parties in providing better access to the wharves

on its sides, before the appropriation by congress in 1886. By the expenditure of this appropriation, the channel has been deepened to 23 feet at mean low water, and made 175 feet wide, for a distance of 1,900 feet from its mouth to Congress Street bridge. Next above this bridge is the railroad bridge of the New York and New England Railroad Company. The piles on which the railroad bridge rests are driven only 19 feet below mean low water, and the bridge does not for this reason admit of a channel 23 feet deep at mean low water through its draw. It seems to be well settled that no further appropriation or expenditure of money by the United States for the improvement of this channel above Congress Street bridge will be made until after such reconstruction by the railroad company of the draw-piers of its bridge as will allow of dredging to the full depth which the improvement contemplates.

The statute which defines the powers and duties of this Board (Public Statutes, chapter 19, section 18) provides that "Said commissioners may, when they deem it necessary, apply to congress for appropriations for protecting and improving any harbor in this Commonwealth." The needs of our harbors have been so ably and carefully studied and so fully presented through the regular official channels by the officers of the United States corps of engineers having them in special charge, and our members of congress have been so watchful and zealous in endeavoring to secure a recognition of these needs in the river and harbor acts, that it has not seemed to be necessary or expedient for this Board to do more than to second the efforts made from time to time to secure some improvement of more than ordinary public importance and of imperative necessity.

In its report for the year 1885, page 52, the Board urged the pressing need of an improvement of this character in Boston Harbor. Emphasizing without repeating what was there said, it is sufficient to state that the main channel of the harbor, having a width at other places of from 1,250 to 4,600 feet, is narrowed down at the Upper Middle, so called, to 600 feet. All deep-draught vessels approaching and leaving the wharves of Boston are crowded into this narrow and dangerous pass. Lieut. Col. Gillespie, the

present able engineer in charge of the harbor, concurs with his predecessors in urging that this stretch of the channel should be widened to 1,000 feet, and an appropriation of \$250,000 is recommended for that purpose. He has applied all available funds at his disposal to the beginning of this work; and it is confidently hoped that provision will be made by the present congress for its continuance and completion. A harbor, however excellent in other respects, lacks one of the first essentials of a good harbor if vessels cannot enter and leave it without apprehension and risk of accident.

GLOUCESTER HARBOR.

All of the time for two or three years past that could well be spared by the engineer and his assistants from other necessary work, has been given to a careful and thorough survey of Gloucester Harbor. By the act of August 5, 1886, congress appropriated \$2,000 for a survey of this harbor preliminary to a project for its improvement by the general government. The two surveys have proceeded together, each availing itself to some extent of the work of the other.

The survey under the direction of the Board was undertaken with especial reference to the re-establishment of the harbor line. Portions of this line had been changed by no less than ten amending acts since its first establishment in 1866, and further changes were desired. In view of the increasing demands upon the capacity of the harbor, and in order that an intelligent opinion might be formed not only in respect to the proper location of the harbor line, but upon the propriety of wharves and other structures which the Board might be asked from time to time to license, it was determined to make the survey as accurate and complete as practicable, both as regards the topography of the harbor and its surroundings, and the water depths over its whole area.

The topographical survey started with a base line between Beacon Hill No. 1 and Railcut Hill, furnished upon the request of the engineer by the United States Coast and Geodetic Survey. From this base twenty-five other stations

were located by triangulation, and their geodetical positions were calculated on the basis of Clarke's spheroid and the coast survey astronomical data of 1880.

With these points as a basis, a plane table survey was made of the wharf lines and of all the topographical features between the water line and the nearest street along the shore, from Niles' Beach to the canal through Pavilion Beach. This survey was executed on four plane table sheets on a scale of $\frac{1}{1000}$. These four sheets have been transferred to one large sheet, 5x7 feet, on the same scale, for an office plan.

For the hydrographic survey, soundings were taken covering the whole of the harbor inside a line drawn across Ten Pound Island from east to west, excepting Babson's Ledge, Harbor Cove, and a section about 400 feet wide along the west shore from the head of the harbor to Fort Wharf. These soundings have been plotted on the large office plan, after being reduced to the plane of mean low water as established by the government surveying party by continuous tidal observations during one lunation. Close soundings were taken by the same party over Babson's Ledge, Harbor Cove and the section along the west shore above described, and these soundings have been copied to complete the office plan.

The existing harbor lines have been plotted in pencil on the large office plan as nearly as they can be, some discrepancies having been found between the several acts by which they have been defined; and some progress has been made in the study of a new harbor line. It is presumed that all parties interested may be heard, after due notice, in respect to the establishment of this new line, in such season that action may be taken, if thought desirable, at the present session of the legislature.

FIELD AND OFFICE WORK.

Miscellaneous Surveys.

During the spring months of the last year, most of the time of the engineer and his assistants was occupied in connection with the operations on the South Boston flats, in giving the lines and grades required in the construction of the sewers in C Street and the connecting streets, and in the general supervision of the work; also in devising and preparing plans and specifications for a retaining sea wall proposed to be constructed on the easterly line of E Street.

In March, a survey was made to fix the points for the establishment by the legislature of a new harbor line on the Chelsea side of Mystic River and Chelsea Creek, between the Chelsea and Meridian Street bridges.

In June, the survey of Gloucester Harbor, of which a full account has already been given, was resumed and continued as other work allowed through the year.

In July, surveys were made to re-establish points of the harbor line on Charles River, the changes and improvements which have occurred there having destroyed more than one-half of the points originally established. At the same time the position of the harbor line on Charles River Basin, opposite the proposed Harvard Bridge, was fixed and marked, and the length of the bridge determined for the engineer of the city of Boston.

In August, a hydrographic survey was made of the whole of Charles River Basin from West Boston Bridge to Brookline Bridge, which will be plotted as soon as other work will allow. A hydrographic survey has also been made of the East Boston front between the Cunard and Carleton's wharves, and plotted on a scale of $\frac{1}{500}$. This was done with a view to the removal the coming season of a shoal off the Eastern Railroad Company's wharf and dock.

In October, a survey was made of the wharf of Francis Joseph in Provincetown harbor, and of the adjoining wharves and property, in order to determine questions arising in respect to the rights of parties upon petitions for wharf extensions.

Since September, the necessary surveys and superintendence incident to the work of grading the streets on the South Boston flats with gravel, have occupied much time.

Licenses Granted and Plans Approved for the Erection of Structures in and over Tide Waters.

The number* of applications the last year for licenses for wharves and other structures in tide waters, has been fully up to the average of past years.

The statute requires the Board, before granting a license, to notify the mayor and aldermen of the city, or the selectmen of the town, within which the proposed work is to be done, that they may appear and be heard. Although this is doubtless a wise provision, these officials rarely appear in response to the notice, because the public interests which they represent do not seem to be involved. The interests most directly affected are usually those of private parties, who are not reached by a notice to the officials of the city or town. To obviate this difficulty, the Board has adopted the rule of requiring the petitioner also to give notice of his application by publication in one or more local newspapers.

It is also the rule of the Board for one or more of its members, with the engineer, to visit the place where the structure is proposed to be built, before granting a license, and to examine into the reasons for or against the petition on the ground.

The following is a list of the licenses granted during the last year : —

Nos.

976. Petition of George Lawley and Son for license to construct a pile pier and pile breakwater in Boston Harbor at South Boston Point. Granted January 27, 1887.
977. Petition of the Boston and Maine Railroad for license to reconstruct and widen its railroad bridge across Mystic River in the city of Somerville and town of Everett. Granted January 27, 1887.
978. Petition of Michael Hurley for license to construct a solid wharf in Lynn Harbor in the city of Lynn. Granted February 24, 1887.
979. Petition of J. W. Stickney for license to construct a wharf partly solid and partly on piles on Chelsea Creek in the city of Chelsea. Granted February 24, 1887.

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Nos.

980. Petition of John N. Cushing, the Philadelphia and Reading Coal and Iron Company, and Benjamin F. Atkinson for license to extend their several wharves by solid filling on Merrimack River in the city of Newburyport. Granted March 3, 1887.
981. Petition of Michael Hurley for license to extend his wharf in Lynn Harbor in the city of Lynn. Granted March 24, 1887.
982. Petition of Augustus B. Martin for license to extend his wharf in Lynn Harbor in the city of Lynn. Granted March 24, 1887.
983. Petition of Joseph A. Stubbs for license to construct a pile wharf in Wellfleet Harbor in the town of Wellfleet. Granted April 14, 1887.
984. Petition of the New Bedford Yacht Club for license to extend its wharf in New Bedford Harbor in the city of New Bedford. Granted April 21, 1887.
985. Petition of the city of Boston for license to reconstruct a wharf on the north-westerly side of Long Island in Boston Harbor. Granted April 21, 1887.
986. Petition of the city of Boston for license to construct a wooden sewer in Mystic River in the Charlestown District in said city. Granted May 12, 1887.
987. Petition of Oliver Ditson and Company for license to extend their wharf on Fort Point Channel in Boston Harbor. Granted April 28, 1887.
988. Petition of the Boston Land Company for license to fill solid a section of its flats in Boston Harbor at East Boston. Granted April 28, 1887.
989. Petition of the heirs of Otis Minot for license to reconstruct and extend their wharf on Charles River in the city of Boston. Granted May 5, 1887.
990. Petition of Anthony Waterman for license to construct a wharf partly solid and partly on piles on Mystic River, Charlestown District, in the city of Boston. Granted June 16, 1887.
991. Petition of John Girdler for license to extend his wharf in Beverly Harbor in the town of Beverly. Granted May 12, 1887.
992. Petition of George Roundy for license to extend his wharf in Beverly Harbor in the town of Beverly. Granted May 12, 1887.

Nos.

993. Petition of William B. Lambert for license to extend his pier and maintain a float at the end of the same in Hingham Bay in the town of Hull. Granted May 12, 1887.
994. Petition of the Boston and Maine Railroad for license to construct a culvert at the sluice-way north of Federal Street in the town of Beverly. Granted May 12, 1887.
995. Petition of the Boston and Maine Railroad for license to fill solid a portion of its bridge across Pines River in the towns of Revere and Saugus. Granted May 19, 1887.
996. Petition of John C. Stanley for license to extend Bayley's wharf, and to maintain as a wharf a dock which has been filled, in Merrimack River in the city of Newburyport. Granted May 26, 1887.
997. Petition of the city of Boston for license to repair the draw-pier of Congress Street Bridge across Fort Point Channel in said city. Granted June 9, 1887.
998. Petition of Joel F. Sheppard for license to extend his wharf in Weymouth Fore River in the town of Quincy. Granted June 9, 1887.
999. Petition of James G. Powers and A. J. Johnson for license to construct a wharf in Buzzard's Bay in the town of Wareham. Granted June 9, 1887.
1000. Petition of the Plum Island Turnpike and Bridge Corporation for approval of plans for building and maintaining a draw in its bridge across Plum Island River, in the town of Newbury, as authorized and required by chapter 279 of the Acts of 1887. Approved June 16, 1887.
1001. Petition of the city of Cambridge for license to build a sea wall and fill solid the area enclosed by the same on Charles River in said city. Granted June 16, 1887.
1002. Petition of William B. Bacon for license to construct a pile wharf in Vineyard Sound in the town of Falmouth. Granted June 16, 1887.
1003. Petition of the Board of Park Commissioners of the city of Boston for the approval of plans for the erection and maintenance of structures for public park purposes, as authorized by chapter 360 of the Acts of 1885, at South Boston Point in said city. Approved July 7, 1887.
1004. Petition of the Old Colony Railroad Company for license to extend its wharf on Taunton River in the town of Somerset. Granted June 23, 1887.

Nos.

1005. Petition of Buchanan Burr for the approval of plans for building a bridge over Pocasset River in the town of Bourne, as authorized by chapter 230 of the Acts of 1887. Approved June 30, 1887.
1006. Petition of the Pigeon Cove Harbor Company for license to construct a sea wall and to fill solid at Pigeon Cove Harbor in the town of Rockport. Granted July 7, 1887.
1007. Petition of the heirs of Maria Tileston for license to construct a sea wall and fill solid on Fort Point Channel in the city of Boston. Granted July 7, 1887.
1008. Petition of Francis Hathaway for license to construct a sea wall and fill solid on Fort Point Channel in the city of Boston. Granted July 7, 1887.
1009. Petition of the city of Haverhill for license to construct a stone arch bridge over Little River in said city. Granted July 14, 1887.
1010. Petition of the Mayors of the cities of Boston and Cambridge and of Leander Greely of said Cambridge, Commissioners, for the approval of plans for a bridge and avenue across Charles River between West Chester Park in Boston and Front Street extended in Cambridge, as authorized by chapter 282 of the Acts of 1887. Approved July 14, 1887.
1011. Petition of the Narragansett Mills for license to lay a water-pipe in Taunton River in the city of Fall River. Granted July 21, 1887.
1012. Petition of the Boston and Maine Railroad for license to fill solid a portion of the water-way of Chubbs Creek in the towns of Beverly and Manchester. Granted July 28, 1887.
1013. Petition of the Onset Bay Grove Association for license to construct a floating stage at Onset Bay in the town of Wareham. Granted July 28, 1887.
1014. Petition of the city of Boston for license to build a water-pipe box and fender along Chelsea Bridge over Mystic River in the cities of Boston and Chelsea. Granted August 11, 1887.
1015. Petition of the Holmes Hole Marine Railway Company for license to drive fast piles on both sides of its railway in Vineyard Haven Harbor. Granted August 18, 1887.
1016. Petition of the city of Boston for license to reconstruct two pile piers at East Boston South Ferry in said city. Granted September 1, 1887.

Nos.

1017. Petition of James W. Emery and others for license to fill solid in Charles River in the city of Cambridge. Granted September 8, 1887.
1018. Petition of the city of Taunton for the approval of plans for the construction of a bridge across Taunton Great River at or near Dean's Wharf in said city, as authorized by chapter 92 of the Acts of 1883. Approved September 1, 1887.
1019. Petition of the Boston and Maine Railroad for license to fill solid a portion of its railroad bridge across Forest River in the city of Salem. Granted September 8, 1887.
1020. Petition of the Boston and Maine Railroad for license to widen the abutments of its railroad bridge across Merimack River in the city of Newburyport. Granted September 8, 1887.
1021. Petition of John S. Ryder for license to construct boat-ways at Stage Harbor in the town of Chatham. Granted September 8, 1887.
1022. Petition of A. H. Ryan for license to construct a pile and timber wharf at Quisset Harbor in the town of Falmouth. Granted September 8, 1887.
1026. Petition of James T. Mosher for license to construct a pile breakwater at the entrance of Menemsha Pond on Vineyard Sound in the town of Chilmark. Granted September 8, 1887.
1027. Petition of John G. Gilbert for license to extend and maintain Atkins Wharf on Charles River in the city of Boston. Granted September 14, 1887.
1028. Petition of John T. Scully for license to fill solid a section of flats in front of his land on Charles River in the city of Cambridge. Granted September 15, 1887.
1029. Petition of the Old Colony Railroad Company for license to construct a bridge and abutments in place of its present pile bridge across Bass River in the towns of Dennis and Yarmouth. Granted September 22, 1887.
1030. Petition of the Lewis Wharf Company for license to construct a pile wharf and sea wall and to remove portions of its present solid wharf in Boston Harbor. Granted September 22, 1887.
1031. Petition of the Boston and Lowell Railroad Corporation for license to widen its passenger bridge and to build a fender on the southerly side of said bridge in Charles River in the city of Cambridge. Granted October 6, 1887.

Nos.

1032. Petition of Lucius M. Sargent for license to construct a stone and timber wharf at Kettle Cove in the town of Manchester. Granted October 20, 1887.
1033. Petition of the Lynn Yacht Club for license to construct a wharf in Lynn Harbor in the city of Lynn. Granted November 17, 1887.
1034. Petition of Thomas A. Watson for license to construct a stone wharf on Monatiquot River in the town of Braintree. Granted October 27, 1887.
1035. Petition of William James for license to extend his wharf in Hull Bay in the town of Hull. Granted October 27, 1887.
1036. Petition of the Fitchburg Railroad Company for license to extend its Pier No. 7 on Charles River, Charlestown District, in the city of Boston. Granted November 3, 1887.
1037. Petition of Michael Cashman for license to extend his wharf in Lynn Harbor in the city of Lynn. Granted November 3, 1887.
1038. Petition of the Walworth Manufacturing Company for license to extend its wharf at South Boston Point in the city of Boston. Granted November 17, 1887.
1039. Petition of Joel F. Sheppard for license to extend his wharf on Weymouth Fore River in the town of Weymouth. Granted December 15, 1887.
1040. Petition of George D. Emery for license to maintain Black's and Gerrish's wharves in Boston Harbor near the junction of Chelsea Creek and Mystic River in the city of Chelsea, pursuant to the provisions of chapter 344 of the Acts of 1887. Granted December 22, 1887.
1041. Petition of Charles A. King for license to construct a stone and timber wharf and dam in Mattapoissett Harbor in the town of Mattapoissett. Granted December 22, 1887.
1042. Petition of the West End Street Railway Company for license to dump snow and ice from certain bridges into the rivers and tide waters in and around the cities of Boston, Cambridge, and Chelsea. Granted December 29, 1887.
1043. Petition of the city of Boston for license to dump snow and ice from certain wharves and bridges into the rivers and tide waters in and around said city. Granted December 29, 1887.

Nos.

1044. Petition of the city of Boston for license to rebuild its wharf, heretofore known as Atkins Wharf, near the mouth of Charles River in said city. Granted December 29, 1887.
1045. Petition of Robert C. Bridge for license to extend his wharf on Marblehead Neck in the town of Marblehead. Granted December 29, 1887.

HARBOR IMPROVEMENTS BY THE UNITED STATES.

The work of the national government in the preservation and improvement of the rivers and harbors on the Eastern section of the coast of Massachusetts, from the New Hampshire state line to and including Provincetown Harbor, has continued in the charge of Lieut. Col. George L. Gillespie, stationed at Boston. The charge of the rivers and harbors on the Southern section of the coast, was assigned on the first day of April last to Major William R. Livermore, as successor to Lieut. Col. George H. Elliot, with office at Newport.

The opportunity which this Board has had to observe the character of the work planned and executed by these officers of the United States Corps of Engineers, makes it a duty to speak in terms of high commendation of the value of their services to the commercial interests of the Commonwealth. It is also a pleasure to acknowledge their courteous co-operation with the Board in the performance of its duties, and the value of the information and advice derived from their professional experience and skill.

Improvements on the Eastern Coast of Massachusetts.

At the request of the Board, Lieut. Col. Gillespie has kindly furnished the following condensed report of the work done in the harbors and rivers under his charge during the year 1887:—

UNITED STATES ENGINEER'S OFFICE,
BOSTON, MASS., December 28, 1887.

The Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN:—I have the honor to furnish, in accordance with your request of December 7, 1887, the following brief statement

of the work done during the year by the general government in those rivers and harbors of Massachusetts that are under my charge : —

1. *Newburyport Harbor.*]

The full section of the north jetty was extended 390 feet, making it 1930 feet long of full section and 745 feet in addition partly built. This indicated new work was done by contract with Mr. Charles H. Edwards, who placed in the jetty 14,991 tons of rubble-stone, 13,590 tons of which were deposited during the year.

No work was done on the Plum Island dyke, the south jetty, or on the sand-catch in its rear. These works remain essentially as stated in my letter to the Board of January 7, 1887, and no change has been made in the project for the improvement of the harbor as therein described.

The severe and frequent easterly storms of the year have thrown up a narrow bar across the 12 foot channel, shown by the survey of June 1886, but through this bar one or more channels affording 9 feet depth, approximately, at mean low water, have been maintained by the river currents, and never before has the harbor entrance been so easy of access and direct as it is now, though the average depth is somewhat less than last year.

2. *Harbor of Refuge, Sandy Bay, Rockport.*

No change has been made in the project for this improvement.

During the year about 88,000 tons of rubble-stone were deposited in the sub-structure of the breakwater, under a contract with the Rockport and Pigeon Hill Granite companies. The sub-structure is now 1940 feet long, all of which is well advanced towards completion. The sub-structure will be completed to the projected plane of 22 feet, mean low water, so soon as studies have been made of the effect by the winter storms upon the stone already deposited.

3. *Gloucester Harbor.*

The chart of the survey of the inner harbor was drawn, and made very complete by the addition of the notes of the partial survey made under your direction. By means of this chart a project for the improvement of the harbor has been prepared and submitted to the Chief of Engineers.

The balance of the funds available for this harbor was expended in removing from Babson's Ledge (just west of the entrance to the inner harbor) about 150 tons of bowlders. This work was done

by contract with Messrs. W. D. Duncan and Nickerson during the months of September, October and November, 1887, and resulted in obtaining at least 14 feet depth of water over the ledge, at mean low tide, where the least depth, before the improvement began, was about 11 feet. It is believed that the existing depth over the ledge is now adequate to the wants of commerce, and no further improvements will be necessary there.

4. *Manchester Harbor.*

A survey was made, a chart prepared, and a project for the improvement of the harbor was submitted to the Chief of Engineers for the action of the ensuing Congress.

5. *Lynn Harbor.*

No change has been made in the project for the improvement of the harbor.

During the year 36,389 cubic yards were dredged from the inner channel under a contract with Mr. A. R. Wright. The total quantity removed under the contract was 50,089 cubic yards. This resulted in making the channel 150 feet wide and 10 feet deep at mean low water, with the exception of a small spur at its inner west end, and two small spurs about the middle of its east side, for the removal of which the funds available did not suffice.

6. *Winthrop Harbor.*

A survey was made, a chart prepared, and a project for the improvement of the harbor was submitted to the Chief of Engineers for the action of the ensuing Congress.

7. *Boston Harbor.*

No change has been made in the project for the improvement of this harbor.

During the year the south and middle head sea-walls at Deer Island were partly re-pointed, and about 600 running feet of the coping course of the Great Brewster sea-wall were re-set.

From Fort Point Channel, during the year, 81,887 cubic yards were removed under a contract with the Bay State Dredging company. The total amount removed under the contract was 94,211 cubic yards. This resulted in completing the channel 1900 feet long, 175 feet wide, 23 feet deep at mean low water, from its mouth to Congress Street bridge. It is not known that any alter-

ation has been made in the draw piers of the New York and New England railroad, on which depends the expenditure of any further appropriation for this channel.

March 19, 1887, a contract was entered into with Mr. J. E. Chapman, to dredge 44,000 cubic yards from the "Lower Middle" shoal and from the "Narrows." When this contract is completed, the main ship channel at the "Lower Middle" will be 900 feet wide, and the passage through the "Narrows" will be more direct.

Operations under this contract were in progress during the latter part of the year, and about 25,000 cubic yards were removed from the "Lower Middle," making the channel 900 feet wide, and 23 feet deep at mean low water. It is expected that this contract will be extended before January 1, 1888, so that the work may be continued to the exhaustion of the available funds, and to the completion of the projected channel opposite the Lower Middle, viz., 1000 feet wide and 23 feet deep at mean low water.

8. *Hingham Harbor.*

No change has been made in the general project for the improvement of this harbor.

Operations were re-commenced early in the spring, under the contract with Messrs. Boynton Bros., and about 150 cubic yards of ledge were removed. This resulted in obtaining a channel 50 feet wide and 10 feet deep at mean low water through the ledge which is situated about 1600 feet north-east of the steamboat wharf.

9. *Scituate Harbor.*

No change has been made in the project for improvement.

Under a contract with Messrs. Boynton Bros., 9,425 cubic yards were dredged from the anchorage basin. The total amount removed under the contract was 18,326 yards, and this resulted in making the basin 350 feet by 400 feet in area, and 7 feet deep at mean low water.

10. *Duxbury Harbor.*

A survey was made, a chart prepared, and a project for the improvement of the harbor has been submitted to the Chief of Engineers for the action of the ensuing Congress.

11. *Plymouth Harbor.*

The project for the preservation and improvement of this harbor remains unaltered.

Under the contract with the New England Dredging Company, 23,124 cubic yards were removed from the improved channel and basin, resulting in widening the channel to 115 feet, 9 feet deep at mean low water, and in deepening the basin to the same depth over about one half of its area, nearest the town wharves.

On Long Beach no work was required.

12. Wellfleet Harbor.

A survey was made, a chart was prepared, and a project for the improvement of the harbor was submitted to the Chief of Engineers for the action of the ensuing Congress.

13. Provincetown Harbor.

The sand-catches near Abel Hill dike were enlarged and extended, and a new one was built near Wood End light.

A study of the hydrographic survey which was completed last year, has convinced me that the damage to the harbor by the advance of House Point Island flats is more dreaded than real, and that the building of the dike, which was planned to arrest this injury, may be safely postponed for the present.

No further work on the beach protections of this harbor has been necessary during the year.

14. Ipswich River.

From this river 4,665 cubic yards were dredged, and several sunken rocks and bowlders were removed. This resulted in making an unobstructed channel through "Labor in Vain" 60 feet wide, and through "The Shoals" 40 feet wide, both 4 feet deep at mean low water.

15. Merrimac River.

No work was done in this river during the year, and its condition is as stated in my letter to the Board previously referred to.

16. Malden River.

No work was done. The improved channel remains in good order.

17. Charles River.

No work was done.

It will be noticed that operations in my district during the year were less than usual, due to the failure of Congress at its last ses-

sion to make an appropriation for rivers and harbors, limiting, in consequence, the expenditures for improvements to the balances from the appropriations of former years. The necessities for the several improvements are as urgent as ever, and they increase gradually from year to year, as improved facilities for navigation give rise to new industries.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col. of Engineers, U. S. A.

Improvements on the Southern Coast of Massachusetts.

The Board is indebted to the courtesy of Major Livermore for a copy of the official report of the work done in the rivers and harbors under his charge during the year ending June 30, 1887, from which the following extracts are made : —

Hyannis Harbor.

This harbor before improvement was an open roadstead exposed to southerly storms. . . . The present approved project contemplates dredging the area protected by the breakwater to a depth of $15\frac{1}{2}$ feet at mean low water, at an estimated cost of \$45,743.20. Congress made an appropriation of \$10,000 therefor in the act of August 5, 1886. . . .

The amount expended during the last fiscal year, including outstanding liabilities, was \$886.41. The result has been the increase of the $15\frac{1}{2}$ foot anchorage area protected by the breakwater about 2 acres. The appropriation of \$20,000 asked for is to be applied to extending the $15\frac{1}{2}$ foot anchorage area. Amount available for fiscal year ending June 30, 1888, \$9,194.40.

Nantucket Harbor.

This harbor is the only one between the harbors of Martha's Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of about 100 miles, except the small harbor of Hyannis on the north side of Nantucket Sound. It has deep water inside, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. . . .

The present approved project is to construct jetties of riprap stone, projecting from either side of the present entrance to the

harbor, for the purpose of concentrating the strength of the tidal currents, and excavating a channel of 15 feet depth by scour, and, at the places where the full depth required will not be reached by this means, to complete the work by dredging. . . .

The amount expended during the last fiscal year, including outstanding liabilities, was \$5,699.65. The construction of the east jetty was continued and fully completed to a distance of about 330 feet from the initial point on the shore, and the foundation was laid and the jetty partially completed for an additional distance of 56 feet. The improvement in the depth of water noted as having followed the construction of the west jetty is still maintained.

The amount asked for [\$50,000] is to be applied to the further extension of the east jetty. Amount available for fiscal year ending June 30, 1888, \$13,468.23.

Wood's Holl Harbor.

The adopted project for the improvement of Great Harbor, Wood's Holl, was for the construction of retaining-walls on the shore, a hollow pier and wharves for the use of the United States Fish Commission, and to serve also as a coaling station for vessels of the Revenue Marine and other branches of the public service, and as a harbor of refuge; also for the removal of dangerous rocks from the strait of Wood's Holl.

A supplemental project for dredging in the rear of the coal wharf extension to afford a berth for public vessels was approved November 27, 1885. . . .

The amount expended during the last fiscal year, including liabilities outstanding June 30, 1887, was \$14,095.79. The pier and retaining walls have been constructed, the basin and berths for vessels have been dredged, and all the wharves as projected have been completed except a small amount of planking on the coal-wharf extension; the dangerous rocks in the strait have been removed and the small amount of dredging in the rear of the coal-wharf extension has been completed.

The completion of the planking of the coal-wharf extension will finish the improvement as far as projected. Amount available for fiscal year ending June 30, 1888, \$451.16.

Wareham Harbor.

The object of the improvement is to deepen and widen the channel leading from Buzzard's Bay to Wareham. The commerce of

Wareham is carried on in sailing vessels, and the channel is to be made a beating channel for such vessels. Another object of the improvement is the raising of Long Beach. . . .

The total amount expended on the improvement up to the close of the fiscal year ending June 30, 1886, including liabilities outstanding at that date, was \$64,952.64, and the result was that the channel in the upper part of the harbor in front of the wharves was carried to its full width and completed, and about one-half of the reach below the wharves was excavated to its full depth of 10 feet below mean low water. Long Beach had been raised above high-water storm tides, except in a few places, so that the major part of the wash of sand into the improved channel inside the beach had been stopped.

The ruling depth of the approaches to Wareham had been increased from 7 to 9 feet, and the channel greatly widened in all the reaches. Vessels of larger draught can be carried to Wareham than formerly. The increase in width of channel was a great help to all vessels in beating in and out of the harbor.

The amount expended during the last fiscal year, including outstanding liabilities, was \$4,751.50. The eastern half of the second and third reaches below the wharves, and one-fourth of the fourth reach, which extends to Barney's Point, were deepened to 10 feet at mean low water. The channel for about one half its width from Barney's Point to Wareham has been deepened to 10 feet.

It is proposed to apply the balance on hand July 1, 1887, and the amount asked for [\$4,000], towards the completion of the channel from the deep water above Long Beach to Wareham. Amount available for fiscal year ending June 30, 1888, \$10,295.96.

Westport Harbor.

This is a new work, no appropriation having been made for it until, by act of August 5, 1886, there was appropriated \$1,000 "for sand fence." . . .

The approved project is to construct wooden jetties, filled with stone, at the end of Horse Neck Point, to stop the wearing of this point; the number and spacing of the jetties to depend on the price at which the work is let.

The available funds are sufficient to construct but one jetty. Work was commenced June 22, 1887, and was in progress at the close of the fiscal year. Amount available for fiscal year ending June 30, 1888, \$890.66.

Taunton River.

The object of the improvement is to deepen and widen the channel leading to the city of Taunton, at the head of navigation, so that vessels of 11 feet draught can reach the city at high water. . .

The amount expended during the last fiscal year to June 30, 1887, including outstanding liabilities, was \$16,229.96. The results were the completion of the channel as proposed between Berkley Bridge and Dighton, with the exception of the removal of a few bowlders and a small amount of dredging, leaving the channel above Berkley Bridge as at the beginning of the fiscal year, as stated above, and vessels of 11 feet draught can now reach Taunton, at the head of navigation.

There remains, to complete the existing project, the completion of the dredging of the channel and the removal of the bowlders between Berkley Bridge and Dighton and widening and deepening at a few points above the bridge. A survey of Taunton River is in progress, and when completed an estimate of the cost will be submitted. Amount available for fiscal year ending June 30, 1888, \$3,381.65.

Connecticut River.—Above Hartford.*

From Holyoke, Massachusetts, 34 miles above Hartford, down to Enfield Falls or Rapids, a distance of 18 miles, there is a fair channel 4 to 5 feet deep. Enfield Rapids extends about 5 miles over a rocky and uneven bed, with a total fall of 32 feet. From the foot of Enfield Rapids to Hartford, a distance of 11 miles, the river bed is broad and sandy, with a channel 2 to 5 feet deep. Several years ago the Connecticut River Company constructed a small canal around Enfield Rapids, through which boats of 3 feet draught and 80 feet length can pass.

The several projects under which work has been done have been for dredging at Barber's Landing and for construction of wing-dams. . . . Up to the close of the present fiscal year, \$100,000 have been appropriated for this part of the river, of which \$90,866.80 have been expended. All the work done has been dredging, construction of seven wing-dams, and repair of the same.

During the past fiscal year the wing-dam at the mouth of Farmington River and the upper wing-dam at Barber's Landing have

* This river is under the official charge of Lieut. Col. David C. Houston, Corps of Engineers, U. S. A.

been repaired where their shore connections had been undermined. . . .

The benefit to be secured by a permanent improvement would be the reduction of cost of transportation of bulky materials to a large manufacturing district now wholly dependent on railroads. Amount available for fiscal year ending June 30, 1888, \$9,133.20.

OFFICE ACCOMMODATIONS.

It is provided in chapter 19, section 2, of the Public Statutes that the Harbor and Land Commissioners "shall be furnished with an office in the state house, or in some other suitable place in the city of Boston, in which the maps, charts, plans, and documents relating to their business and to the harbors and lands in their charge, and records of all their doings and of the doings of the several boards to whose duties they have by law succeeded, shall be kept."

A large collection of such maps, documents and records is now in the keeping of the Board. They contain valuable evidence of titles and rights of the Commonwealth and of individuals. They are of frequent use for public and private reference, and are indispensable to the Board in the performance of its duties. The number of harbor and other plans and charts is about 3000. They have cost much time, labor and money. Many of them are original plans, which could not be replaced without great difficulty and expense, and some of them could not be replaced at all. It is impossible not to feel some solicitude in respect to their preservation and safety.

There have been assigned for the use of the Board two connected rooms on the first floor of the Commonwealth Building, a basement room beneath, and a room on the third floor. Under the basement room is a cellar used by the chief of the district police for the storage of seized and forfeited liquors. The basement room was designed to be used as the work room of the engineer and his assistants, but was found too unwholesome for that purpose, and is now used chiefly as a store room for plans and other papers, as is also the third-story room, which is too remote from the office proper for other convenient use. Substantially all the work of the commission is crowded into the double room on

the first floor, which serves also for public hearings, as well as for the storage of the plans and records of most frequent use.

It goes without saying that a first-class public building is not to be expected from a reconstructed dwelling house. The alterations of the Commonwealth Building were not such as to improve its stability or security from fire. The apprehension of danger from weakness of floors and partitions, of which there were both visible and audible signs, has been relieved by the removal of some tons of books and documents belonging to another department from one of the upper stories. The risk from fire, smoke and water, or other accident, still continues. The Board desires to relieve itself of some measure of responsibility for the safe keeping of its archives by calling attention to their present exposed condition.

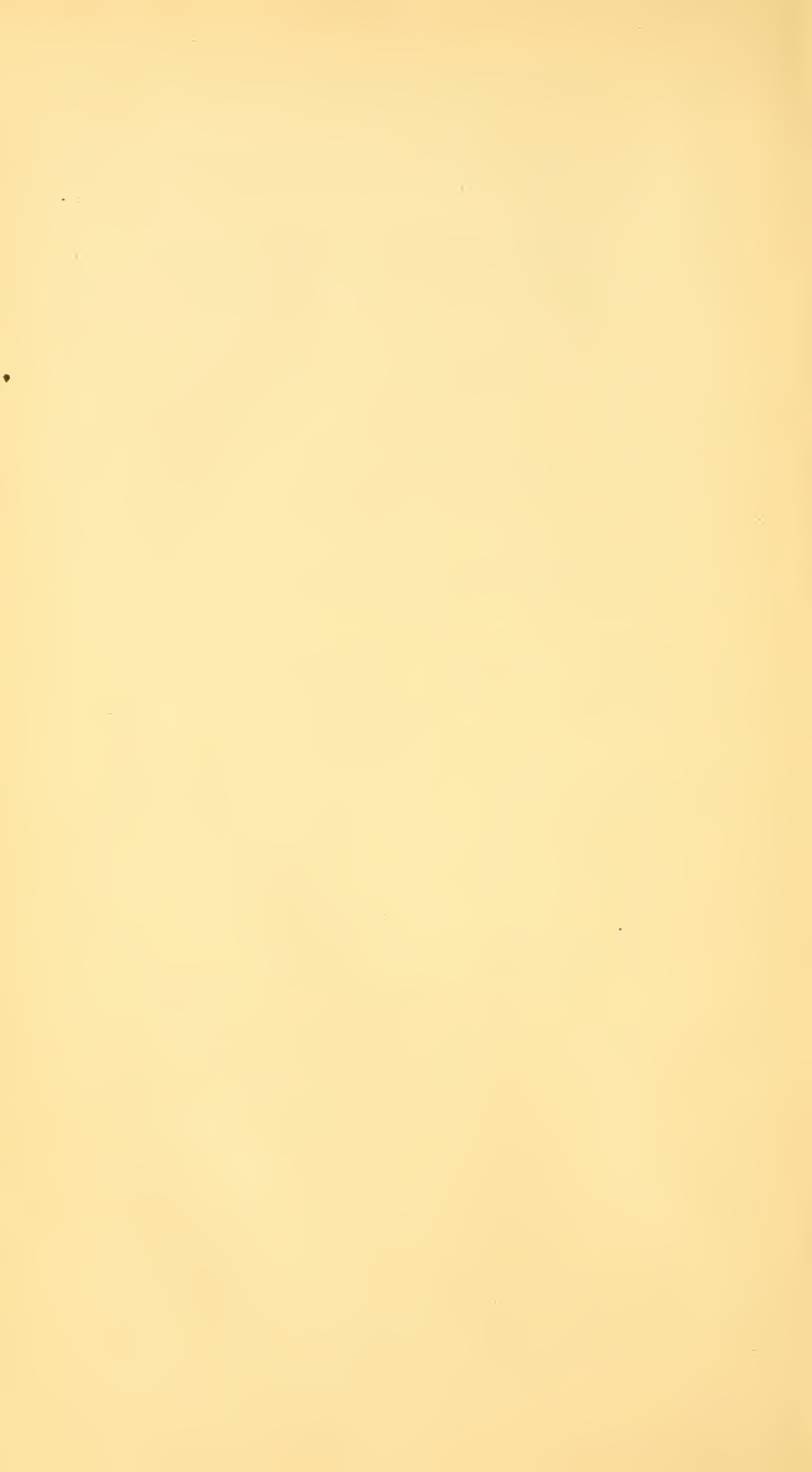
The foregoing Report is respectfully submitted.

JOHN E. SANFORD.

JOHN I. BAKER.

CHARLES H. HOWLAND.

Boston, January 1, 1888.



APPENDIX.

APPENDIX.

[A.]

[See page 6 of this Report, *ante.*]

AN AGREEMENT, MADE THIS FOURTEENTH DAY OF MARCH, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-SEVEN, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY ITS BOARD OF HARBOR AND LAND COMMISSIONERS, AND SUBJECT TO THE APPROVAL OF ITS GOVERNOR AND COUNCIL, PARTY OF THE FIRST PART, AND ARTHUR PUTTERILL AND JAMES KILLIAN, COPARTNERS, BOTH OF AND DOING BUSINESS AT BOSTON IN SAID COMMONWEALTH, UNDER THE NAME OF PUTTERILL AND KILLIAN, PARTIES OF THE SECOND PART.

Said parties of the second part agree with said party of the first part to do all the work and furnish all the materials for building a 30x42-inch main brick sewer, about 1,290 feet long, in C Street, on the South Boston Flats, from Claffin Street to Congress Street, with pipe sewers connecting therewith in the intersecting streets, and with man-holes, catch-basins and connections, all as shown on plans on file in the office of the Board of Harbor and Land Commissioners, marked "South Boston Flats Sewers, A, B, C, D, E and F, February, 1887," which plans are to be referred to as a part of this agreement; it being understood, however, that no sewer or other work or details already done or shown on said plans, more than ten feet east of C Street, are to be considered as in any manner referred to or included herein.

All excavations to be made true to line and grade as given to said parties of the second part, the bottom of sewer trenches to be formed exactly to the shape of the outside of the sewer or

sewer foundation. If any excavation is made too deep, it is to be refilled to proper grade with suitable material well rammed into place.

The trenches to be thoroughly braced and planked wherever necessary, and to be kept free from water during the progress of the work, and only such length opened at once as directed by the inspector.

Said parties of the second part to be responsible for all damages arising from, or in consequence of, the construction of the sewer and other work. All injuries to water and gas or other pipes to be made good by said parties of the second part.

The main sewer in C Street to be of brick, egg-shaped, 30x42 inches inside, with a timber foundation or platform four feet six inches wide, built of 3-inch spruce plank resting on 4x6-inch spruce stringers, all as shown on said plans.

The main sewer to be connected at Clafin Street in a thorough and workmanlike manner with the end of the existing main sewer, and in extension thereof, and the outer end of main sewer at Congress Street to be securely bricked up.

The backing of the haunches to be packed solid and rammed, and the brickwork covered before drawing centres. Centres to remain as long as forty-eight hours after the brickwork is completed, if required by the inspector.

All slants for connections to be built into the brickwork as it proceeds, and the outer ends left carefully stopped.

Man-holes to be built of brick and in the manner shown on the plans, and to be capped with a cast-iron curb and cover like the regular city of Boston curb and cover. The brickwork to be at least eight inches thick throughout.

The sewers in the streets intersecting C Street to be of 12-inch Akron or Portland salt-glazed sewer pipe, in 3-foot lengths, laid to line and grade as given to the contractor, with joints close butted and well filled with mortar, each joint to rest on a piece of board at least 12x8 inches in size and one inch thick, and the pipe to be scraped clean inside after laying, and not left bearing on the sleeves. Branches to be put in as directed by the inspector, and left carefully stopped.

The catch-basins to be built according to the plans, of spruce timber, sawed square, sound and free from large knots, and connected with the sewer by 10-inch Akron or Portland salt-glazed sewer pipe, laid as provided for the pipe sewer.

All bricks used to be hand-made, uniform in size, regular in shape, tough and burned very hard entirely through. No bats to

be used, except a small proportion in the outer ring of the arch and outer course of man-holes. The most regular bricks to be selected for the inner ring of the invert of sewer.

All bricks to be laid in mortar composed of two parts of clean, sharp sand, and one part of best American cement, fresh mixed; joints to be full and laid to line; joints of invert to be struck with trowel; bricks to be well wetted before laying, and to be laid by experienced masons.

Cement to be fine ground; clear cement mortar to be capable of sustaining a tension of forty pounds per square inch twenty-four hours after mixing.

All wood work to be of spruce, sawed square, sound and free from large knots.

The best dirt from the trenches, entirely free from stones, to be carefully rammed around the foundations, sewer and pipes, and the remainder placed in the trenches in layers of not over two feet, and thoroughly rammed or puddled. Any surplus material from excavations to be deposited and levelled in places and in a manner directed by the inspector, but no such surplus material to be required to be moved more than one hundred feet from place where excavated.

No allowance to be made for any loose stones or boulders found in excavating.

The work to be kept perfectly clean and free from brickbats, dirt, etc., as built and until accepted, and the whole to be done subject to the inspection and direction of the engineer of said Board and his inspector at all times.

All bricks, pipes and other stock and materials delivered for the work to be piled up, and covered or otherwise protected, as directed by the inspector.

The number and location of the pipe sewers, man-holes, catch-basins and connections, slants and branches, as shown on plans, may be varied by direction of said engineer or his inspector, notice of changes being given to said parties of the second part in season so as not to require any alteration of work already done, and the additions or omissions not to exceed fifty per centum of those shown on the plans.

Any details shown on the plans, and not mentioned herein, must be considered a part of this agreement, and are to be fulfilled by said parties of the second part.

In all questions which may arise concerning measurements, lines and grades, the decision of said engineer shall be final.

All necessary aid and materials for giving or indicating lines

and grades must be furnished by said parties of the second part at their own expense; and convenient facilities for the inspection of the work must be furnished whenever requested.

All instructions and directions of said engineer, or his authorized assistants, must be strictly observed and followed.

All of the work must be done to the satisfaction of said engineer, and in a manner to be approved by him, and to the acceptance of said Board.

The work must be commenced the first of April, 1887, and must be prosecuted vigorously in all suitable weather until completion; and must be fully completed on or before the thirtieth day of June, 1887.

Estimates will be made by said engineer of the amount of work done and completed up to the end of each calendar month, and payment will be made thereon of seventy-five per centum of the contract prices for such work, as computed by said engineer; and the remaining twenty-five per centum will be paid upon the final completion and acceptance of the whole work.

And said parties of the second part hereby agree to do all the work, to furnish all the materials, and to do, furnish, perform and complete all other things provided for in the foregoing specifications and plans, subject to the terms and conditions therein set forth, for the following prices or sums, the same to be in full compensation for all the work, materials, and other things done, furnished, performed and completed as aforesaid, namely:—

For the 30x42-inch brick sewer and foundation, per running foot, four dollars and thirty cents (\$4.30); for each 12-inch slant built in, one dollar and eighty cents (\$1.80); for each 10-inch slant built in, one dollar and fifty-five cents (\$1.55); for each 6-inch slant built in, seventy-five cents (\$0.75); for 12-inch pipe sewer, per running foot, seventy cents (\$0.70); for each branch of same, one dollar and twenty cents (\$1.20); for each catch-basin, thirty-seven dollars (\$37.00); for catch-basin connections, per running foot, fifty-five cents (\$0.55); for each man-hole, including curb and cover, thirty-eight dollars (\$38.00).

And said party of the first part, for the considerations aforesaid, hereby agrees to pay to said parties of the second part the prices or sums aforesaid, at the times and in the manner, and upon the terms and conditions, hereinbefore set forth.

IN WITNESS WHEREOF, said party of the first part, acting by its Board of Harbor and Land Commissioners, has caused these presents to be executed in its name and behalf, and to be approved

by its Governor and Council, and its seal to be hereto affixed; and said parties of the second part have hereto set their hands and seals, the year and day first above written.

THE COMMONWEALTH OF MASSACHUSETTS,

BY JOHN E. SANFORD,	}	<i>Harbor and</i>
JOHN I. BAKER,		<i>Land</i>
CHAS. H. HOWLAND,		<i>Commissioners.</i>

ARTHUR PUTTERILL. [SEAL.]

JAMES ^{his} X KILLIAN. [SEAL.]
mark

In Council, March 23, 1887. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

HENRY B. PEIRCE, *Secretary.*

[B.]

[See page 7 of this Report, *ante*.]

ARTICLES OF AGREEMENT, MADE THIS TWENTY-SECOND DAY OF AUGUST, IN THE YEAR EIGHTEEN HUNDRED AND EIGHTY-SEVEN, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, PARTY OF THE FIRST PART, AND THE NEW YORK AND NEW ENGLAND RAILROAD COMPANY, PARTY OF THE SECOND PART.

The said party of the second part hereby covenants and agrees with the said party of the first part to do all the work, and furnish all the materials, for filling with gravel, as hereinafter specified, the following streets on the South Boston Flats, reference being had for the location thereof to the plan of a portion of said Flats accompanying the report of the Board of Harbor and Land Commissioners of said Commonwealth for the year 1886, namely:—

C Street, and a strip 10 feet wide on the easterly side of B Street for the purpose of widening the same, each from the southerly line of Cypher Street to the northerly line of Congress Street; and Cypher, Anchor, Bullock, Claflin, Danby, Egmont, Fargo and Congress Streets, and Mt. Washington Avenue, each from B Street to C Street.

Said streets to be filled so as to have, after the work is completed, their top surface at grade 16.

The width of the top surface of said streets, measured at said grade 16, after the work is completed, to be as follows: Congress Street, 75 feet wide; B Street (including present width of 50 feet), and C Street, each 60 feet wide; and each of the other streets, 50 feet wide.

The slope of the filling on the sides of said streets to be one and one-half horizontal to one vertical.

The material used for filling to be clean, coarse gravel, free from rocks, large stones or boulders, clay, loam and vegetable matter, and satisfactory in all respects to the engineer of said Board; and to be deposited, levelled and trimmed in accordance with the lines, grades and directions given by said engineer.

The amount of gravel to be paid for to be ascertained by measurement in the fill after it has been deposited, levelled and trimmed as aforesaid, and no filling to be paid for which is more than 6 inches outside the prescribed lines, grades and slopes.

Said party of the second part to be responsible for all damages to persons or property arising from or in consequence of the work of filling, or from anything done in connection therewith. All injuries to sewers, man-holes, and catch-basins and connections to be made good by said party of the second part.

The work to be commenced on or before September 1, 1887, and to be prosecuted with all practicable dispatch in all suitable weather, and to be fully completed on or before June 1, 1888.

In all questions which may arise concerning measurements, lines and grades, the decision of said engineer to be final.

All necessary aid and materials for giving or indicating lines and grades to be furnished by said party of the second part at its own expense; and convenient facilities for the inspection of the work to be furnished whenever requested.

All instructions and directions of said engineer, or his authorized assistants, to be strictly observed and followed.

All of the work to be done to the satisfaction of said engineer, and in a manner approved by him, and to the acceptance of said Board.

Estimates to be made by said engineer of the amount of work done and completed up to the end of each calendar month, and payment to be made thereon of ninety per centum of the contract price for such work, as computed by said engineer; and the remaining ten per centum to be paid upon the final completion and acceptance of the whole work.

And said party of the second part hereby agrees to do all the work, to furnish all the materials, and to do, furnish, perform and complete all other things provided for in the foregoing specifications. subject to the terms and conditions therein set forth, for the price or sum of sixty-five (65) cents for each cubic yard of gravel filling, the same to be in full compensation for all the work, materials, and other things done, furnished, performed and completed as aforesaid.

And said party of the first part. for the considerations aforesaid, hereby agrees to pay to said party of the second part the price or sum aforesaid, at the times and in the manner, and upon the terms and conditions, hereinbefore set forth.

Said party of the second part also agrees, without charge to said party of the first part, on or before November 1, 1887, to

complete the filling of Congress Street, westerly of B Street, with gravel, 75 feet wide, to grade 16.

IN WITNESS WHEREOF, said party of the first part, acting by its Board of Harbor and Land Commissioners, has caused these presents to be executed in its name and behalf, and to be approved by its Governor and Council, and its seal to be hereto affixed; and said party of the second part, by James W. Perkins, Assistant to its President, thereunto duly authorized, has hereto set its corporate name and seal, the year and day first above written.

THE COMMONWEALTH OF MASSACHUSETTS,

By JOHN E. SANFORD,	}	<i>Harbor and</i>
JOHN I. BAKER,		<i>Land</i>
CHAS. H. HOWLAND,		<i>Commissioners.</i>

NEW YORK AND NEW ENGLAND RAILROAD CO.,

By JAMES W. PERKINS,	[SEAL OF THE N. Y. & N. E. R. R. CO.]
<i>Assistant to President.</i>	

In Council, September 7, 1887. Approved.

Witness the Seal of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

HENRY B. PEIRCE,
Secretary of the Commonwealth.

[C.]

[See page 8 of this Report, *ante*.]PROPOSED FORM OF DEED AND AGREEMENT FOR A RESERVED
CHANNEL ON THE SOUTH BOSTON FLATS.

COMMONWEALTH OF MASSACHUSETTS.

WHEREAS, it is desired that the proprietors of the lands, wharves and flats situate on the northerly shore of South Boston, east of E Street, may not be cut off from access to the sea by reason of the filling and other work to be done by the Commonwealth in the improvement of its lands and flats there lying in front of the wharves and flats of said proprietors ;

AND, WHEREAS, it is necessary, in order to obviate this result, that the Commonwealth, in the plans which it may adopt for the further prosecution of its said improvement, shall make provision for a RESERVED CHANNEL to connect the wharves and flats of said proprietors with the main ship channel ;

AND, WHEREAS, it is not practicable to locate such reserved channel so as to secure the interests and convenience both of said Commonwealth and of said proprietors, without mutual agreement and co-operation in respect to the location thereof ;

AND, WHEREAS, it is proposed and agreed in respect to any channel which may be so reserved,

(1) That such channel shall be not less than four hundred (400) feet wide its entire length, and shall connect with the main ship channel at some convenient point above Castle Island ;

(2) That such channel may be located partly on the land and flats of the Commonwealth, and partly on the flats of said proprietors, *provided*, that the inner (or southerly) side line of such channel shall not at any point be nearer than thirteen hundred and twenty-one and five-tenths (1321.5) feet to the northerly side line of West First Street ; nor, at any point west of a line drawn midway between O and P streets extended, be nearer than thirteen hundred (1300) feet to the northerly side line of East First Street ;

(3) That the Commonwealth, as fast as it fills its territory, advancing eastward from E Street, shall dredge such channel, abreast the filled territory, so that it shall afford safe and convenient passage at mean high water for vessels drawing not less than twenty-two (22) feet ;

(4) That the Commonwealth shall not, at any time during the progress of its work, and before the extension of such reserved channel to a junction with the main ship channel, cut off or obstruct, by any filling or other work done by it or under its authority, the access to the sea of any wharf proprietor who becomes a party hereto, his heirs, successors or assigns, without first providing for him or them other access to the sea by some channel or course having at least as deep water as that so cut off or obstructed ;

(5) That such of said proprietors as become parties hereto, their heirs, successors and assigns, shall have perpetual right, in common with each other and with the Commonwealth and its assigns, to use such reserved channel, for purposes of navigation, in the same manner, and with the same privileges and immunities, as natural tide-water channels are or may be lawfully used in this Commonwealth ;

(6) That such of said proprietors as become parties hereto, their heirs, successors and assigns, shall have the right to fill and to build and extend wharves, piers and other lawful structures, upon and over their respective flats, northerly to or towards the inner (or southerly) side line of such channel, subject in other respects to the provisions of chapter 19 of the Public Statutes, but without being required to make or pay compensation for tide-water displaced by such structures ;

(7) That the Commonwealth shall not, by reason of this instrument, be under any obligation, express or implied, to reserve a channel as aforesaid, unless the proprietors of all the flats which lie between E Street extended and a line drawn midway between O and P streets extended, become parties hereto ;

NOW, THEREFORE, We, the undersigned, proprietors as aforesaid, upon the considerations, and subject to the conditions, reservations and limitations hereinbefore set forth, do hereby severally give, grant and convey unto the Commonwealth of Massachusetts, and its assigns, a perpetual right, easement and privilege to use, occupy and improve, for the uses and purposes of such reserved channel, and for no other uses and purposes whatsoever, so much of our respective parcels of flats, situate at said South Boston, in the County of Suffolk and Commonwealth aforesaid, as lie within an area bounded *northerly* by the main

ship channel, *westerly* by E Street extended, *easterly* by a line drawn midway between and parallel to O and P streets extended, and *southerly* by a line running easterly from said E Street parallel to and thirteen hundred and twenty-one and five-tenths (1321.5) feet distant northerly from the northerly side line of West First Street, until it intersects a line drawn parallel to and thirteen hundred (1300) feet distant northerly from the northerly side line of East First Street, and thence by said last described parallel line to the aforesaid easterly bound midway between O and P streets; and we do hereby severally remise, release and forever quit-claim unto said Commonwealth, and its assigns, all our right to use, occupy or improve so much of our respective parcels of flats, and of the lands and flats of the Commonwealth, as lie within said area, for any uses or purposes other than those of such reserved channel.

It is, however, further agreed, and these presents are upon the express condition, that the foregoing grant, release and agreement shall be void and of no effect as regards any portions of said lands and flats which, though included in the above described area, may lie southerly of such reserved channel as hereafter actually located by said Commonwealth; and shall be wholly void and of no effect whatever, unless, within two years from the date hereof, a reserved channel shall have been in fact located across the above described area, and the plans therefor, and the provisions of this instrument, been duly approved by the Governor and Council of said Commonwealth, as required by chapter 46 of the Resolves of the year 1886.

Reference may be had to the accompanying plan for the westerly, southerly and easterly limits of the above described area, within which limits a reserved channel may, by the terms hereof, be located.

IN WITNESS WHEREOF, we have hereunto set our respective names, hands and seals, this first day of July, A. D. 1887.

Executed in presence of

COMMONWEALTH OF MASSACHUSETTS.

BOSTON,

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Approved by the Governor and Council.

Secretary of the Commonwealth.

[SEE PLAN. OVER.]

